TRAFFIC ENGINEERING

OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

COVER: A clean looking island separates traffic in Miami Beach, Fla.

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Frankly Speaking

PUBLIC RELATIONS as practiced by traffic engineers in the city of Chicago is producing results for both the public and the city government. It is the type of public relations which receives little publicity, accounting perhaps for the lack of detailed information presently available.

In order to keep the public aware of traffic engineering developments and at the same time establish a source for complaints, Chicago traffic engineers, according to our reporter, are holding regularly scheduled meetings in various sections of the city. Here the opportunity is afforded for both the public and the city representatives to iron out neighborhood traffic problems. By holding the meetings at predetermined regular intervals, the public knows that complaints can be directed to the city representatives responsible, thus eliminating the need for groups to visit the city hall, seek out their alderman, and engage in long and costly conferences.

It is hoped the Chicago traffic engineers will tell us more about these "town meetings" on traffic. Traffic engineers need good public relations and if the Chicago type is proving successful, other traffic engineers should be informed.

Robert O. Swain

Editor

Short Count Results

by V. H. Pelz and James T. White

In the Spring of 1946, the Traffic Audit Bureau, Inc. (TAB) conducted an intensive survey in Fort Wayne for the purpose of getting data on many questions relating to traffic volume and the movement of people outdoors that are of interest to sellers of outdoor advertising and to the advertisers who buy it.

One part of the TAB survey involved the estimating of traffic volume at over 200 outdoor advertising locations in and near the city. The cost of making such a large number of counts continuously for either 12 hours or 18 hours would have been prohibitive. It was imperative, therefore, that some "short" or "sampling" method be used which would yield reasonably accurate estimates.

Estimates were needed not only of the number of automotive vehicles (exclusive of mass transportation) at each of these locations, but also of the *number of people in the vehicles*, and of the number of pedestrians. This need obviously involved counts manually rather than by the use of automotive traffic counting devices.

At about the same time, the city of Fort Wayne was planning to conduct a traffic survey to obtain information needed for developing a program to relieve increasing congestion in the downtown area. An important part of the project was the determination of the total volume of vehicular traffic entering and leaving the central business district. This meant that a cordon count was required, involving some 69 counting stations, plus numerous other counts both inside and outside the cordon. In some cases, counts required by TAB were at the same points required by the city, but the number of such "duplicate" counting stations was not a large part of the total number of counts required.

From the standpoint of the City Traffic Engineering Department it was financially impossible to conduct elaborate traffic counts with all the office requirements, tabulation, and adjustments due to the important factor of time, and available personnel. Consequently, it was money-wise that the city employ a reliable method of ascertaining vehicular traffic trends quickly, economically, and covering the maximum number of locations with the minimum staff of recorders. Thus short-count, or sample methods had to do the trick.

Both authors thus faced the same necessity of having a "short" or "sampling" method of estimating total traffic at a given location that would be reasonably accurate.

Vickery Count Method

In the Fall of 1945, TAB had asked the Yale Bureau of Highway Traffic Research for any literature in its library dealing with short count methods of any kind. Of the rather limited material available, the most significant was an unpublished paper written in 1939 by C. W. Vickery, then Chief Statistician, Texas Highway Planning Survey, which intimated a practical method of estimating street traffic by means of extremely short count methods. Past procedures, well known to traffic engineers, of ascertaining traffic volume through master, secondary and local station count methods, were challenged by Mr. Vickery when he stated, "The assumption that a factor which is correct at one point is also correct at another, is precarious."

The following are further quotations from that paper which will sum-

marize the method proposed by Vickery:

> "This paper undertakes to present a method for replacing a continuous count for a given period by a series of extremely short counts spaced at intervals over the period. . . . The traffic over the entire period is estimated from the series of periodic short counts by making use of quadrature formulas from the calculus of finite differences.
>
> "The thing of importance is not so much the total time during which traffic is counted at a point, but the distribution of the counts over the entire day.
>
> "It is relatively unimportant whether we count traffic for five minutes at a time or only 1 minute at a time, provided only that we have a considerable number of such counts spaced at equal intervals over the entire day.
>
> ". . . . the simplest of all quadrature formulas is the trapezoidal rule. Suppose that we have a series of twenty-five counts, each of duration 1 minute, and spaced 1 hour apart from center to center. It is immaterial whether the counts are made on the hour, just so they are spaced 1 hour apart. The trapezoidal rule tells us that to estimate the total traffic for the 24-hour day, we take the average of the first and last counts, to this add the sum of the remaining 23 counts, and multiply by 60, this being the number of minutes in an hour.
>
> "While the principles that have been discussed are mathematically sound, observational data are not readily available for calculating the reliability of such estimates and for answering such questions as the minimum duration of individual count periods that may be used under various traffic conditions. For this purpose it would be desirable to have a great many traffic counts taken under various conditions and recorded by short intervals of time, by minutes, for example, or possibly even shorter intervals. Most traffic figures now available are recorded by hour or half-hour periods."

Preliminary Test

While the method as outlined seemed entirely sound, in terms of accepted statistical principles of sampling, Vickery himself did not have data to test its reliability. Nor could any other example of actual field test be found. It was, therefore, highly desirable, if possible, to check the validity of the method before adopting it for either survey in Fort Wayne. The co-authors of this paper closely correlated their efforts in an experimental test of the advantages of the Vickery short count method.

The City of Fort Wayne, through its Traffic Engineering Department, maintains a fairly close check upon ten (10) locations strategically located throughout the city. These locations give traffic trends upon the basis of industrial locations; State Highway traffic entering the city; local residential and highway traffic; local business and highway traffic; local traffic to the central business district, no disturbing factors; and, the central business district, with two locations upon Federal State Highway routes, and one local thoroughfare.

In line with Vickery's reasoning, it seemed likely that five minute counts out of each hour would provide a satisfactory combination of accuracy and cost. (In retrospect, six minutes would have been better, since it would have provided a 20% larger sample at virtually no increase in cost, since a counting crew usually could cover comfortably only five locations at a time. In addition, computation of estimates would have been easier, since a six minute count out of each hour involved multiplying by 10, whereas a five minute mount involved multiplying by 12).

The first step in the preliminary test was to divide each fifteen-minute automatic count into three five-minute counts. This was admittedly an arbitrary procedure; if the trend in volume was upward from one fifteen-minute period to another, then the first five minutes (out of a given 15-minute period) was allocated somewhat less than one-third of the 15-minute total, and the third five minutes somewhat more than one-third, and vice versa if the trend was downward. This step gave assumed five-minute counts throughout the 24 hours at each location.

The next step was to add the counts for a given five-minute period in each of the 24 hours, and multiply the sum by 12, since 5 minutes is one-twelfth of an hour. This computation thus yielded an *estimated* total for the 24 hours, which could be compared with the known actual total.

For each location, then, there were 12 different estimates, since there are twelve five-minute periods in each hour, and hence twelve different periods in which counts might be made in actual field practice of rotating crews from one location to another. Thus it was necessary to know whether the use of a given five minutes out of each hour would yield a substantially different estimate than any other five-minute period.

The results of the procedure yielded estimates that were surprisingly accurate. It was recognized, of course, that these estimates were probably more accurate than those based on actual five-minute counts because the arbitrary division (as described above) of 15-minute counts into 3 five-minute counts would result in a far smoother curve than would be shown by actual counts.

Nevertheless, the results were such as to justify the use of the method, in principle, for both the TAB and city traffic counting operations. Since detailed figures based on actual counts are given later, there is no need to give details of the preliminary test.

One modification was made, however, in the method as stated by Vickery, which was based on the assumption that an estimate of 24-hour traffic would require 25 counts spaced one hour apart. Study of the automatic counter data indicated that the results from 25 counts instead of 24, treated in accordance with the formula, would not yield an increase in accuracy sufficient to warrant the increase in cost.

It was decided, therefore, to limit counts to the period for which estimates were desired. In the TAB survey, these periods were either for 18 hours (6 A.M. to midnight) or 12 hours (6 A.M. to 6 P.M.), depending on whether poster panels at these locations were illuminated at night. In the city survey, the hours for which estimates were needed were from 6 A.M. to midnight at points on the Cordon, and from 7 A.M. to 7 P.M. at all intersection locations.

Field Test Plan

With the preliminary test, as outlined above, indicating the validity of the Vickery method, it was decided to give it a final field test, based on one-day continuous 18-hour counts (6 A.M. to midnight), at 14 locations in Fort Wayne. These locations were selected as representative of all types of traffic; five were in the downtown district, nine outside.

Records were made manually. For vehicular traffic, an entry was made of the number of riders in each passenger car, truck or taxi, so that the number of entries provided a count of vehicles. Pedestrians were likewise counted. All records were kept by five-minute periods. Where traffic was heavy, separate checkers were placed on each side of the street.

Counts at these 14 locations were made between April 30 and May 8, 1946. Weather was generally clear with occasional rain.

All data given below covers traffic moving in both directions, and in the case of pedestrians, on both sides of the street.

Intersection Field Test

Sample counts were conducted at intersections noting the usual data desired from any intersection traffic counts. These counts were in turn compared to those automatically recorded and an error of less than five per cent was found to prevail.

Conclusive evidence had now been presented which would support the principle of sampling intersection traffic flow. The area of the survey encompassed 69 intersections, at which 12-hour counts (sample principle) was scheduled for a normal week day. (Note: Maxwell Halsey was retained by the City of Fort Wayne as Traffic Consultant, and approval of the

Table 1 - A

Vehicular Traffic, Both Directions, By 5 Minute Periods, For 18 Hours, On Clinton St. s/o Wayne, Tuesday, April 30, 1946

Hour	FIVE MINUTE PERIODS 0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	Hour Total	% of 18 Hours
6 - 7 AM	15	12	16	18	25	32	43	47	39	50	63	31	391	2.68
7 - 8 "	32	32	43	48	38	47	67	71	82	97	84	93	734	5.04
8 - 9 "	71	62	80	75	72	66	59	71	75	70	56	64	821	5.64
9 - 10 "	67	67	68	68	64	73	59	73	64	76	56	70	805	5.53
10 - 11 "	61	76	60	59	57	67	71	57	73	96	68	61	806	5.53
11 - 12 "	56	65	42	81	72	62	55	82	72	77	62	79	805	5.53
12 - 1 PM	75	96	92	63	63	82	74	61	79	68	97	59	909	6.24
1 - 2 "	67	81	61	77	77	81	77	86	73	78	57	81	896	6.15
2 - 3 "	88	75	92	88	94	82	60	78	73	61	81	78	950	6.52
3 - 4 "	88	82	78	77	84	52	77	99	106	81	78	111	1,013	6.95
4 - 5 "	85	90	97	87	82	91	129	97	114	121	95	102	1,190	8.17
5 - 6 "	107	126	126	114	106	119	88	102	122	81	83	63	1,235	8.48
Total 12 Hr.	812	862	855	855	834	856	859	924	972	956	880	892	10,555	
x 12	9,744	10344	10,260	10,260	10,008	10,248	10,308	11,088	11,664	11,472	10,560	10,704	(Av.Dev. 4.3%	
% of Actual	92.3	98.0	97.2	97.2	94.8	97.1	97.7	105.0	110.5	108.7	100.0	101.4	(Stan.Dev. $\pm$ 5.3%	
6 - 7 PM	76	83	74	63	71	70	47	70	49	56	63	51	773	5.31
7 - 8 "	76	55	55	83	70	112	74	58	60	79	71	67	840	5.77
8 - 9 "	102	76	68	68	65	58	52	68	55	75	79	65	831	5.70
9 - 10 "	51	59	63	47	46	44	54	41	53	56	51	38	603	4.14
10 - 11 "	55	51	41	39	43	22	58	45	44	39	52	34	523	3.59
11 - 12 "	31	28	40	53	49	38	36	43	26	22	46	21	443	3.04
Total 18 Hr.	1,203	1,214	1,196	1,208	1,183	1,198	1,180	1,249	1,239	1,283	1,242	1,161	14,568	100.01
x 12	14,436	14,568	14,352	14,496	14,256	14,376	14,160	14,988	14,868	15,396	14,904	14,016	(Av.Dev. 2.2%	
% of Actual	99.1	100.0	98.5	99.5	102.2	98.7	97.2	102.9	102.1	105.7	102.3	96.2	(Stan.Dev. $\pm$ 2.6%	

Table 1 - B

Auto-Truck Passenger Traffic, Both Directions, By 5 Minute Periods, For 18 Hours, On Clinton St. s/o Wayne, Tuesday, April 30, 1946.

Hour	FIVE MINUTE PERIODS 0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	Hour Total	% of 18 Hours
6 - 7 AM	23	17	18	40	53	61	84	77	90	76	92	40	671	2.71
7 - 8 "	56	57	66	76	58	69	108	105	129	163	142	144	1,173	4.74
8 - 9 "	100	83	129	108	95	91	170	109	105	93	80	96	1,259	5.09
9 - 10 "	98	94	95	102	84	114	84	112	88	102	74	98	1,145	4.63
10 - 11 "	106	102	86	94	91	100	114	82	113	150	99	84	1,221	4.93
11 - 12 "	77	82	68	125	98	96	83	127	101	117	91	124	1,189	4.80
12 - 1 PM	101	126	135	88	85	136	110	99	128	90	131	93	1,342	5.42
1 - 2 "	100	129	96	115	108	126	120	139	112	125	90	120	1,380	5.58
2 - 3 "	133	106	147	131	160	117	89	122	122	96	131	123	1,477	5.97
3 - 4 "	141	137	129	129	159	92	132	179	169	121	128	179	1,695	6.85
4 - 5 "	143	164	156	135	136	158	224	196	195	206	156	173	2,042	8.25
5 - 6 "	190	194	204	188	164	195	147	189	209	146	149	108	2,103	8.50
Total 12 Hr.	1268	1311	1325	1331	1291	1355	1465	1536	1581	1485	1363	1382	16,697	
x 12	15216	15732	15948	15972	15492	16260	17580	18432	18972	17820	16356	16584	(Av.Dev. 6.0%	
% of actual	91.1	94.2	95.5	95.7	92.8	97.4	105.3	110.4	113.6	106.7	98.0	99.3	(Stan.Dev. $\pm$ 6.9%	
6 - 7 PM	130	152	128	117	134	144	106	140	96	105	104	92	1,448	5.85
7 - 8 "	148	114	105	181	136	223	147	128	82	145	147	143	1,699	6.87
8 - 9 "	225	157	140	142	140	108	112	133	108	143	170	140	1,718	6.94
9 - 10 "	93	126	133	108	96	99	122	83	97	122	102	71	1,272	5.14
10 - 11 "	106	102	93	84	67	45	109	91	83	74	105	62	1,021	4.13
11 - 12 "	67	67	76	111	110	69	26	50	46	81	41	49	892	3.60
Total 18 Hr.	2037	2019	2004	2074	1995	2043	2128	2207	2097	2140	2072	1931	24,747	100.00
x 12	24444	24228	24048	24888	23940	24516	25536	26484	25164	25680	24864	23172	(Av.Dev. 2.8%	
% of actual	98.8	97.9	97.2	100.6	96.7	99.1	103.2	107.0	101.7	103.8	100.5	93.6	(Stan.Dev. $\pm$ 3.4%	

Table 1 - C

Pedestrian Traffic, Both Directions, By 5 Minute Periods, For 18 Hours On Clinton St. s/o Wayne, Tuesday, April 30, 1946

Hour	FIVE MINUTE PERIODS 0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	Hour Total	% of 18 Hours
6 - 7 AM	2	2	2	2	0	0	2	2	1	5	4	4	26	.46
7 - 8 "	2	2	1	1	8	3	8	10	13	11	15	9	83	1.47
8 - 9 "	13	4	12	14	26	10	17	10	11	12	12	12	153	2.71
9 - 10 "	11	12	16	16	12	28	19	32	17	19	21	18	221	3.92
10 - 11 "	20	14	22	16	24	30	25	17	13	41	26	13	261	4.63
11 - 12 "	36	28	28	45	27	53	67	61	60	62	61	59	577	10.23
12 - 1 PM	68	81	60	43	59	62	48	80	58	46	75	38	718	12.72
1 - 2 "	63	54	60	54	39	56	44	55	42	44	36	43	590	10.46
2 - 3 "	50	43	43	36	32	43	38	29	35	37	39	22	447	7.92
3 - 4 "	38	32	38	31	53	46	38	40	32	43	33	44	468	8.29
4 - 5 "	38	46	48	43	44	35	47	27	46	31	34	34	491	8.70
5 - 6 "	59	53	74	50	43	80	52	31	27	42	24	32	615	10.90
Total 12 Hr.	390	369	404	349	367	446	405	414	385	393	380	348	4,650	
x 12	4,680	4,428	4,848	4,188	4,404	5,352	4,860	4,968	4,620	4,716	4,560	4,176	(Av.Dev. 5.5%	
% of Actual	100.6	95.2	104.3	90.1	94.7	115.1	104.5	106.3	99.4	101.4	98.1	89.8	(Stan.Dev. $\pm$ 6.9%	
6 - 7 PM	29	33	16	15	19	23	13	29	13	27	15	11	248	4.39
7 - 8 "	12	25	7	10	35	23	10	13	18	22	18	5	198	3.51
8 - 9 "	18	22	17	19	11	43	15	17	16	9	17	11	215	3.81
9 - 10 "	25	9	10	12	12	9	3	15	3	14	8	2	122	2.16
10 - 11 "	6	8	22	4	10	2	8	10	6	6	12	4	102	1.81
11 - 12 "	6	12	8	67	7	3	0	1	0	2	2	0	108	1.91
Total 18 Hr.	486	478	484	476	461	549	454	499	450	473	452	331	5,643	100.00
x 12	5,832	5,736	5,808	5,712	5,532	6,588	5,448	5,988	5,400	5,676	5,424	4,572	(Av.Dev. 5.4%	
% of Actual	103.3	101.6	102.9	101.2	98.0	116.7	96.5	106.1	95.7	100.6	96.1	81.0	(Stan.Dev. $\pm$ 7.9%	

Table 2 - A

Summary Data For 12 Estimates Of Total Vehicular Traffic, Both Directions, At Each Of 14 Locations

Location	Day	Date	Total Volume 12 Hours	Total Volume 18 Hours	Range of Estimates ($) 12 Hours High	12 Hours Low	18 Hours High	18 Hours Low	Average Deviation ($) 12 Hrs.	Average Deviation ($) 18 Hrs.	Standard Deviation ($) 12 Hrs.	Standard Deviation ($) 18 Hrs.
Clinton St. s/o Wayne	Tues.	4/30/46	10,555	14,568	110.5	92.3	105.7	96.2	4.3	2.2	5.3	2.6
Maumee e/o Comparet	Wed.	5/1/46	10,590	14,338	117.4	90.3	113.0	94.0	5.8	4.6	7.7	5.8
Fairfield n/o Penn. R.R.	Mon.	5/6/46	9,881	13,339	117.0	89.7	113.6	89.2	5.9	5.6	7.7	6.8
Van Buren n/o Superior	Mon.	5/6/46	8,380	11,323	120.0	89.9	115.6	89.8	8.0	6.5	9.8	8.1
Columbia St. Bridge	Mon.	5/6/46	6,855	9,691	113.3	88.9	109.5	93.2	8.1	4.3	9.0	5.2
Washington w/o Calhoun	Mon.	5/6/46	7,003	9,491	109.0	88.9	106.0	89.3	5.0	4.0	6.1	4.7
Anthony n/o Wayne Trace	Wed.	5/1/46	6,125	8,646	124.2	80.7	113.3	82.6	9.9	6.2	12.4	7.9
Broadway n/o Lavina	Thu.	5/2/46	5,553	7,897	113.7	90.3	110.8	90.1	4.2	3.3	6.4	4.8
Rudisill w/o Calhoun	Mon.	5/6/46	5,304	7,638	121.5	83.0	110.8	90.5	8.3	5.0	10.5	6.1
Piqua n/o Rudisill	Wed.	5/8/46	5,001	7,167	110.6	90.0	109.2	91.8	5.8	4.1	6.6	5.0
Main w/o Van Buren	Thu.	5/2/46	4,125	5,769	113.7	90.2	107.7	94.4	5.8	3.4	7.2	3.9
State e/o Kentucky	Mon.	5/6/46	4,128	5,643	107.6	91.3	108.5	94.6	4.3	2.8	5.1	3.7
Calhoun n/o Penn. R.R.	Mon.	5/6/46	2,952	4,073	113.8	87.4	107.2	89.0	6.2	5.0	7.5	5.6
Wells s/o Irene	Thu.	5/2/46	2,275	3,044	119.2	84.9	112.7	91.9	8.5	7.0	9.5	7.7

Table 2 - B

Summary Data For 12 Estimates Of Total Automotive Passenger Traffic, Both Directions, At Each Of 14 Locations

Location	Day	Date	Total Volume 12 Hours	Total Volume 18 Hours	Range of Estimates ($) 12 Hours High	12 Hours Low	18 Hours High	18 Hours Low	Average Deviation ($) 12 Hrs.	Average Deviation ($) 18 Hrs.	Standard Deviation ($) 12 Hrs.	Standard Deviation ($) 18 Hrs.
Clinton St. s/o Wayne	Tues.	4/30/46	16,697	24,747	113.6	91.1	107.0	93.6	6.0	2.8	7.0	3.5
Maumee e/o Comparet	Wed.	5/1/46	17,057	24,443	117.3	88.1	113.2	91.1	6.3	5.1	8.0	6.5
Fairfield n/o Penn. R.R.	Mon.	5/6/46	14,993	21,237	121.3	86.6	115.5	88.4	8.1	6.1	9.6	7.7
Van Buren n/o Superior	Mon.	5/6/46	13,736	19,154	122.4	90.3	116.6	90.7	7.9	6.5	9.6	7.9
Columbia St. Bridge	Mon.	5/6/46	10,333	15,347	113.1	88.3	109.8	91.1	9.0	4.9	9.4	5.7
Washington w/o Calhoun	Mon.	5/6/46	11,118	15,741	109.7	87.0	107.0	87.7	5.5	3.5	6.7	4.7
Anthony n/o Wayne Trace	Wed.	5/1/46	9,512	14,262	130.1	77.0	116.2	81.1	11.4	6.6	14.6	8.9
Broadway n/o Lavina	Thu.	5/2/46	8,940	13,224	117.0	91.0	110.6	89.4	7.8	4.4	8.8	5.6
Rudisill w/o Calhoun	Mon.	5/6/46	8,470	12,851	121.6	83.3	111.8	91.3	8.4	5.7	10.3	6.4
Piqua n/o Rudisill	Wed.	5/8/46	7,977	11,822	113.0	84.8	112.0	91.3	5.1	5.2	7.0	6.4
Main w/o Van Buren	Thu.	5/2/46	6,056	9,192	117.5	91.5	109.4	93.9	6.8	3.5	8.0	4.3
State e/o Kentucky	Mon.	5/6/46	6,708	9,508	109.3	93.6	110.3	93.0	4.0	4.1	4.8	5.2
Calhoun n/o Penn. R.R.	Mon.	5/6/46	4,332	6,397	115.5	80.9	110.3	83.3	7.4	6.0	9.4	7.6
Wells s/o Irene	Thu.	5/2/46	3,816	5,249	121.1	83.6	115.0	88.2	9.0	8.3	10.8	9.3

Table 2 - C

Summary Data For 12 Estimates Of Total Pedestrian Traffic, Both Directions, At Each Of 14 Locations

Location	Day	Date	Total Volume 12 Hours	Total Volume 18 Hours	Range of Estimates ($) 12 Hours High	12 Hours Low	18 Hours High	18 Hours Low	Average Deviation ($) 12 Hrs.	Average Deviation ($) 18 Hrs.	Standard Deviation ($) 12 Hrs.	Standard Deviation ($) 18 Hrs.
Clinton St. s/o Wayne	Tues.	4/30/46	4,650	5,643	115.1	89.8	116.7	81.0	5.5	5.4	6.9	7.9
Maumee e/o Comparet	Wed.	5/1/46	2,350	3,165	169.0	79.7	142.2	86.8	17.2	11.1	23.6	15.2
Fairfield n/o Penn. R.R.	Mon.	5/6/46	898	1,024	183.1	65.5	173.4	66.8	24.0	23.0	31.0	29.9
Van Buren n/o Superior	Mon.	5/6/46	901	1,100	138.5	69.3	129.8	66.5	15.0	11.3	18.3	15.1
Columbia St. Bridge	Mon.	5/6/46	529	599	131.6	83.9	126.2	86.1	8.2	8.8	11.9	10.9
Washington w/o Calhoun	Mon.	5/6/46	7,339	8,813	111.7	79.6	110.8	86.1	8.0	5.6	9.3	7.1
Anthony n/o Wayne Trace	Wed.	5/1/46	613	812	162.5	43.1	158.1	60.6	23.3	21.4	29.2	25.9
Broadway n/o Lavina	Thu.	5/2/46	1,984	2,540	168.8	77.4	152.1	74.6	20.6	17.6	28.6	22.2
Rudisill w/o Calhoun	Mon.	5/6/46	422	653	156.4	39.8	141.5	60.6	29.9	24.1	37.0	26.4
Piqua n/o Rudisill	Wed.	5/8/46	141	189	144.7	42.6	133.3	69.8	25.5	17.7	30.3	21.2
Main w/o Van Buren	Thu.	5/2/46	641	917	116.1	78.6	121.7	85.1	10.8	9.4	12.2	11.3
State e/o Kentucky	Mon.	5/6/46	985	1,223	136.4	75.5	122.6	78.5	13.5	10.1	16.7	12.7
Calhoun n/o Penn. R.R.	Mon.	5/6/46	1,790	2,369	107.9	91.8	111.9	89.7	4.4	5.4	5.1	6.5
Wells s/o Irene	Thu.	5/2/46	257	314	182.1	60.7	156.7	53.5	17.4	18.6	28.5	25.7

sample count principle received his endorsement).

Data For One Location

Table 1-A, 1-B and 1-C show traffic volume, of vehicles, passengers, and pedestrians respectively, by five-minute periods, on Clinton Street south of Wayne Street on Tuesday, April 30, 1946, for the 18 hours from 6 A.M. to midnight. The sum of the hourly five-minute counts (for 12 or 18 hours) when multiplied by 12, gives the estimated traffic based on the particular five minutes out of each hour. Dividing each of the 12 estimates by the known actual total traffic gives the percentage of estimated total.

Referring to Table 1-A as an example: the highest estimate of total 18-hour vehicular traffic was 105.7%, based on counts made during 45-50 minutes of each hour. The lowest estimate was 96.2%, based on counts during 55-60 minutes of each hour. The average deviation (from 100%) of the 12 estimates of 18-hour traffic was 2.2%. The standard deviation of the 12 estimates was 2.6%. The standard deviation is the square root of the mean of the deviations squared. It is a more significant measure than the average deviation because—when the distribution from which it is computed is perfectly symmetrical, with the mode in the center of the distribution—68.2% of the values will be found between plus and minus one standard deviation from the mean.

Summary Data

There is no need to repeat the detailed data for each of the other 13 locations. But the summary data for all of them are shown in Table 2-A, 2-B and 2-C.

From Table 2-A it is evident that —regardless of which five minutes is used to count vehicular traffic—the great majority of all possible counts at any of these locations would have been within 10%. For estimating 18 hour vehicular traffic, the highest standard deviation for any of the 14 locations was 8.1%, and for 12 hour estimates the highest standard deviation was 12.4%.

There is some correlation, but not too close, between volume of traffic and accuracy of estimates. While volume is a factor in accuracy, the hour by hour character of the flow curve at a given location is equally important, especially if there are sharp fluctuations *within* an hour. For example: at Van Buren north of Superior, which is on a feeder route into the downtown area, peak hour fluctuations were quite pronounced, so that even with considerable volume, the standard deviation of estimates was larger than at other locations having smaller but more normal flow curves.

From Table 2-A it is evident that errors of estimates of automotive *passenger* traffic were higher at every location than were the estimates of vehicular traffic. This is due largely to the fact that load factors (average number of persons per vehicle) differ sharply between locations and between hours of the day at a given location. Data on load factors is shown in Table 3.

Table 2-C shows that estimates of pedestrian traffic was much less accurate than for automotive traffic. Pedestrian traffic is by nature fluctuating and erratic, and is subject to sudden spurts in volume caused by lunch hours, store opening and closing hours, office hours, etc.

Only two of the 14 locations in Fort Wayne had more than 5,000 total 18 hour pedestrian traffic, but for both of these the standard deviation of estimates was under 10%.

Hence it may well be assured that the Vickery method (as applied to pedestrian traffic) is reasonably accurate only when traffic volume is relatively large. This is confirmed by a test of the method (using five-minute

Table 3 -

Load Factors At 14 Locations In Ft. Wayne

Location	Total Vehicles (18 hours)	Total Passengers (18 hours)	Load Factor (18 hours)	Range of Hourly Load Factors High	Low
	(All figures include traffic in both directions)				
Clinton s/o Wayne	14,568	24,747	1.70	2.11	1.42
Fairfield between Taylor and Brackenridge	13,339	21,237	1.59	1.90	1.38
Maumee between Comparet and University	14,338	24,443	1.70	2.06	1.45
Washington w/e Calhoun	9,491	15,741	1.66	1.98	1.44
Columbia St. Bridge	9,691	15,347	1.58	1.88	1.39
Broadway n/o Lavina	7,897	13,224	1.67	1.98	1.44
Van Buren n/o Superior	11,323	19,154	1.69	2.01	1.50
Calhoun n/o Penn. R.R.	4,073	6,397	1.57	1.97	1.27
Anthony between Luther and Penn. R. R.	8,646	14,262	1.65	2.13	1.37
State between Kentucky and Crescent	5,643	9,508	1.68	1.91	1.39
Wells s/o Irene	3,044	5,249	1.72	2.02	1.46
Main w/o Van Buren	5,769	9,192	1.59	2.15	1.30
Piqua n/o Rudisill	7,167	11,822	1.65	1.95	1.47
Rudisill between Calhoun and Harrison	7,638	12,851	1.68	2.03	1.42

counts) on December 2, 1947, at two locations in New York City, at which *only men* were counted. One location was on the west side of Fifth Avenue, just south of 38th Street; the other location was on the south side of 38th Street, just west of Fifth Avenue: Total male pedestrian traffic for eight hours (9:30 A.M. to 5:30 P.M.) was 12,510 and 3,553 respectively. The standard deviation of 12 estimates on Fifth Avenue was 5.0%, and on 38th Street was 9.0%.

An interesting sidelight on the character of traffic flow in Fort Wayne is shown in Table 4. These figures indicate that automotive passenger traffic was noticeably higher in the period of 35-50 minutes out of each hour.

Accuracy of Estimates of Combined Traffic at a Group of Locations

In addition to the need for short count method of estimating traffic at individual locations, there is also desired—both by traffic engineers and those interested in outdoor advertising —a short count method for estimating with considerable accuracy the combined traffic at a *group* of locations. For example: a traffic engineer might be interested in knowing the *total* volume entering or leaving the downtown area, to be determined by a cordon count. The buyer or seller of outdoor advertising is likewise inter-

Table 4

Total Actual Auto-Truck Passenger Traffic at 14 Locations, By Five-Minute Periods Out of Each Hour

Five-Minute Period Out of Each Hour	Total Auto-Truck Passenger Traffic at 14 Locations	
	18 hours	12 hours
0- 5	16,737	10,903
5-10	16,666	11,216
10-15	16,955	11,163
15-20	16,642	11,009
20-25	16,176	10,922
25-30	16,230	11,010
30-35	16,610	11,511
35-40	17,649)	(12,593
40-45	18,068)	(13,001
45-50	17,947)	(12,918
50-55	16,982	11,905
55-60	16,512	11,594
Total	203,174	139,745

ested, for both often want to know how many people are exposed to the panels in a poster showing, which consists of a given number of such panels.

Now the results obtained from applying the Vickery method to each of 14 locations in Fort Wayne also serve to indicate the relative accuracy of the method when applied to the *combined* traffic at all 14 locations.

In actual field practice the entire 14 locations would seldom if ever be counted in the *same* five-minute period out of each hour. Instead, counting crews would rotate from one location to another within each hour. Table 5 shows one such schedule which might be followed for counting at 14 locations for five minutes out of each hour.

To cover the 14 locations in Fort Wayne would require three crews, if all 14 locations were counted on the *same* day. Two crews would each take care of five locations, the third covering four locations. If only one crew is used, then 5 locations would be counted one day, 5 the next, and 4 on the third day. Locations assigned to a crew covering five would obviously be those that are fairly close together. For these two crews it has been assumed that locations are close enough together—as they were in Fort Wayne—so that five minutes allowance for travel time between locations was ample. This gave these two crews a ten-minute rest period at the end of each hour. The crew covering four locations was allowed

Table 5

Assumed Schedule A For Traffic Counting Crews, Using 5 Minute Method, At 14 Locations
(Would Require Two Crews Each Covering 5 Locations, And One Crew Covering 4 Locations)

	CREW NUMBER AND FIVE MINUTE PERIOD IN WHICH EACH LOCATION WOULD BE COUNTED											
Location	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
1	1											
2			1									
3					1							
4							1					
5									1			
6	2											
7			2									
8					2							
9							2					
10									2			
11	3											
12				3								
13							3					
14										3		

Table — 6

Summary Of 12 Possible Schedules (A-L) For Traffic Counting Crews Using 5 Minute Method At 14 Locations
(Each Schedule Would Require Two Crews Each Covering 5 Locations, And One Crew Covering 4 Locations)

	5 MINUTE PERIOD IN WHICH EACH LOCATION WOULD BE COUNTED UNDER EACH SCHEDULE											
Location	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
1	A	B	C	D	E	F	G	H	I	J	K	L
2	K	L	A	B	C	D	E	F	G	H	I	J
3	I	J	K	L	A	B	C	D	E	F	G	H
4	G	H	I	J	K	L	A	B	C	D	E	F
5	E	F	G	H	I	J	K	L	A	B	C	D
6	A	B	C	D	E	F	G	H	I	J	K	L
7	K	L	A	B	C	D	E	F	G	H	I	J
8	I	J	K	L	A	B	C	D	E	F	G	H
9	G	H	I	J	K	L	A	B	C	D	E	F
10	F	F	G	H	I	J	K	L	A	B	C	D
11	A	B	C	D	E	F	G	H	I	J	K	L
12	J	K	L	A	B	C	D	E	F	G	H	I
13	G	H	I	J	K	L	A	B	C	D	E	F
14	D	E	F	G	H	I	J	K	L	A	B	C

ten minutes travel time between locations, which would be ample normally. Actually, this crew could "squeeze out" some rest time if travel time was less than ten minutes, for obviously it is not necessary that counting start exactly at 5 or 10 or 15 minutes after the hour just so long as each count, whenever started, lasts exactly five minutes. In other words, the count could be made from 6:12 to 6:17 just as well as from 6:15 to 6:20.

Obviously, many such schedules could be worked out, each involving different combinations of locations and starting times during the hour.

In order to find out whether a particular schedule made any appreciable difference in the estimates based on the use of the five-minute method in actual field practice, twelve such assumed or hypothetical schedules were set up. These twelve possible schedules for counting the 14 locations are shown in Table 6. Schedule A in Table 6 is simply a repetition of the same Schedule as shown in Table 5.

Then, for each assumed schedule, the actual known traffic figures for the particular five-minute periods used at each location were combined to get *total estimated traffic for the 14 locations considered as a unit.*

The results are shown on Tables 7-A, 7-B and 7-C for vehicular, automotive passenger, and pedestrian traffic, respectively.

These tables indicate a remarkable degree of accuracy of estimates of combined traffic for a *group* of locations, based on the use of the Vickery method, especially for vehicular and automotive passenger traffic.

Table 7-A

Estimated vs. Actual Total Vehicular Traffic at 14 Locations if Based on Five-Minute Method According to Schedules Shown in Table 6.

Schedule	Per Cent of Estimated to Actual Total Vehicles at 14 Locations	
	18 Hours	12 Hours
A	99.8%	99.1%
B	99.7	100.2
C	101.0	103.0
D	99.3	100.0
E	100.1	99.7
F	101.8	102.9
G	99.9	98.7
H	101.1	100.9
I	100.1	100.2
J	100.4	100.0
K	98.3	96.3
L	98.4	99.1
Average deviation of 12 Schedules	0.8%	1.2%
Standard Deviation of 12 Schedules	± 1.0%	± 1.7%
Number within ± 10%	12	12
Number within ± 5%	12	12
Number within ± 2%	12	9

The method of sampling intersection traffic followed this procedure: One (1) pair of recorders were assigned six (6) intersections; a 12-hour sample count was to be conducted for five minutes, "*no-more*" or "*no-less*", at each location, permitting a travel period of 5 minutes between intersections. In this manner 4 recorders working 6 hours each made it possible to sample 6 intersections for each group of four per day, except where traffic conditions warranted more than 2 recorders per intersection; and with the manpower employed for the survey, all field work at 69 intersections was completed in two days, requiring 246 man hours, including field supervisors and relief personnel.

Summary

1. A modified form of the Vickery short count method, in which estimates of total traffic at a given location were based on counts made for five minutes out of each hour, was tested in Fort Wayne in the spring of

Table 7 - B

Estimated vs. Actual Total Auto-Truck Passenger Traffic at 14 Locations if Based on 5-Minute Method According to Schedules Shown in Table 6.

Schedule	Per Cent of Estimated to Actual Total Passengers at 14 Locations	
	18 Hours	12 Hours
A	99.0%	98.9%
B	98.5	98.9
C	100.9	103.0
D	98.7	99.8
E	100.6	99.9
F	102.3	103.6
G	100.5	99.6
H	101.9	102.3
I	100.3	100.2
J	100.5	99.6
K	98.4	96.2
L	98.3	98.0
Average ~~deviation~~ of 12 Schedules	1.2%	1.5%
Standard deviation of 12 Schedules	± 1.3%	± 2.0%
Number within ± 10%	12	12
Number within ± 5%	12	12
Number within ± 2%	11	8

1946. The test was based on 18-hour continuous counts at 14 locations, with data recorded by 5-minute periods, thus permitting "hindsight" analysis of the accuracy of the method.

2. For estimating 18-hour *vehicular* traffic, the standard deviation of estimates at all of the 14 locations was 8.1% or less, and at 9 of the 14 it was 6% or less.
3. For estimating 18-hour *automotive passenger* traffic, the standard deviation of estimates at all of the 14 locations was 9.3% or less, and at 9 of the 14 it was 6.5% or less.
4. The method was much less accurate for estimating 18-hour pedestrian traffic. However, at three out of five locations having total 18-hour pedestrian traffic of more than 2,000 the standard deviation of 12 estimates was 7.9% or less. No location with less than 2,000 18-hour pedes-

Table 7 - C

Estimated vs. Actual Total Pedestrian Traffic at 14 Locations if Based on 5-Minute Method According to Schedules Shown in Table 6

Schedule	Percent of Estimated To Actual Total Pedestrians at 14 Locations	
	18 hours	12 hours
A	100.6%	99.1%
B	99.1	97.9
C	101.6	103.2
D	97.8	96.7
E	103.2	103.9
F	111.0	114.4
G	107.5	111.0
H	103.9	107.2
I	94.8	93.7
J	94.6	91.2
K	94.3	91.1
L	91.6	90.6
Average deviation of 12 Schedules	4.6%	6.6%
Standard deviation of 12 Schedules	± 5.6%	± 7.7%
Number within ± 10%	11	10
Number within ± 5%	6	5
Number within ± 2%	3	1

trian traffic had a standard deviation less than 10%.

5. Estimates of 12-hour traffic—vehicular, automotive passenger, and pedestrian—were less accurate than for 18-hour traffic.
6. When applied to the *combined* traffic at the 14 locations as a whole, based on 12 different schedules of rotation of counting crews, the standard deviation of the 12 estimates of 18-hour vehicular traffic was 1.0%, of 18-hour automotive passenger traffic was 1.3%, and of 18-hour pedestrian traffic was 5.6%.
7. A compilation of the survey indicated that sample counts were more quickly summarized in the office, and that the field work was accurate and within the limits of human error. The factor of reducing the human elements of errors may be cited as reducing the time required at a given location, and actual concentration of assignment during a shorter work period; as a matter of fact each recorder was schooled in the importance of the work he was performing, and that he had a so-called rest period during every other five-minute period of his work day. Also, the importance of sampling traffic movements through a given location for periods of "five minutes", "no-more", or "no-less", was deeply impressed upon the mind of each recorder and field supervisor.
8. While sample counts have been cited as a practical means of ascertaining street conditions it is equally important to state that in highly concentrated areas of traffic flow it may be possible to shorten the sample period, and conversely so in areas where traffic is erratic and less concentrated, it would be more profitable, and with greater assurance of accuracy to sample the location more frequently than one (1) five-minute period per hour. In any event sample methods have proven satisfactory, and their use is dependent upon the factors which generate the traffic around a given locality.

Average automotive speeds in 1947, as reported by the Federal Public Roads Administration recently, were still under the prewar figure. Summarized in the PRA speed report were observations of 105,449 vehicles on main rural highways in 14 states.

According to the study, the average motor vehicle speed in 1947 on these roads was 46.8 miles per hour, as against 47.1 miles per hour prewar.

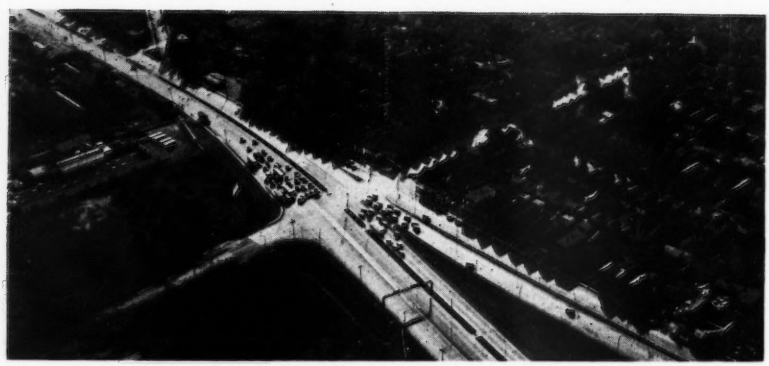
Slightly over one-third of the passenger cars observed in the speed studies traveled over 50 miles per hour, while only 12 per cent of the trucks observed did so.

However, possibly reflecting the replacement of many slower trucks since the war, average truck speeds have been increased 1.8 miles an hour to a rural average of 42.2 miles an hour, the PRA figures show.

SIGN VANDALS

Marksmen who draw beads on rural traffic signs with guns or rocks are one of the little-known headaches of highway maintenance men. In Kentucky, for instance, 12,000 signs were shot up or banged up last year, at a replacement cost of some $30,000.

STOP AND GO -- BIRDEYE'S VIEW



Above and below: Looking down on signalized intersection at south end of dual-dual section of U. S. 1 near Newark Airport. Note the use of paved shoulder by truck and passenger vehicles. *Public Roads Photo*

GRADE CROSSING PROTECTION

Visitors to the Chicago Railroad Fair this summer will have an opportunity to observe at close range, the operation of Model 10 Automatic Signals—safety devices regarded by traffic experts to be the last word in grade crossing protection. One of those signals will be installed on the Intramural Railroad (narrow gauge track over which the Burlington will carry sight-seeing passengers). Another Model 10 will be placed in operation on the Union Pacific miniature railroad.

A new windshield glass with a transparent film of oxide 20-millionths of an inch thick to carry an electric current has been developed by Libby-Owens-Ford Glass Co. to eliminate icing and fogging, it was reported last week.

The new product named Electrapane, was developed for the armed forces secretly during the war and was used in military equipment.—Copied from "Dealer News", Los Angeles, California, June 30, 1948.

British "I.T.E."

by LT. COL. MCLAGAN, *D.S.O.*

ARISING out of an investigation of the problem of vehicle parking both in England and in the U. S. A. by C. G. Griffin and L. F. Dyer who have been studying this subject for many years, it was found that progress was to a large extent dependent on a review of road traffic as a whole. It was early appreciated that such a review involved many other issues besides parking and that a limited number of investigators would not be able to cover it. Accordingly invitations were sent out to City Engineers, Surveyors, Architects, Chief Constables and others who might be interested to join in the research which appeared to be required. An excellent response was obtained and many persons who are qualified to pronounce on the various aspects of road traffic have joined to form the *Road Traffic Study Group*. This has now been constituted with objects a note of which is attached.

While there is ample information available in this country on several subjects which are essentially linked with the traffic problem such as Highway Construction and Engineering, Transport Management, etc., it is somewhat surprising to find that very little is forthcoming on the overall subject of traffic management and the science of traffic engineering. This arises largely because in few instances is the duty of traffic management assigned to the same official in any two localities and, so far as could be ascertained, in no case in the United Kingdom is an official appointed to handle traffic as his sole duty.

The cities of the North American continent have carried this to its logical conclusion and as a result an *Institute of Traffic Engineers* exists as an authoritative body embracing the specially trained and qualified officials who have been appointed solely for this purpose in practically every large town and city.

In Great Britain, the traffic subject is usually attached as an extra duty to the Chief Constable, the City Engineer, or even to the Town Clerk himself, not one of whom has the time or the opportunity to study its complexities. It is hoped that the Road Traffic Study Group may be able to help these officials and perhaps to elevate what is an overwhelming problem in all urban areas into a special duty requiring the whole time effort of trained minds.

It is proposed to pursue the study of the traffic problem by means of papers presenting special aspects of the study sphere followed by discussions. Where particular details are to be examined, sub-committees will be employed. All persons interested will be welcomed and it is hoped eventually to build a fully representative and authoritative body whose recommendations on ascertained methods and improvements in traffic handling will be of value to those responsible for the problem in their respective areas.

A representative library has been collected which contains most of the recent literature issued in North America where more has been written on this subject than elsewhere, and links have already been established with overseas organizations who are ready and willing to assist by an interchange of information.

The first paper of the group entitled "THE CAR PARKING PROBLEM—REQUIREMENTS OF ANY ADEQUATE SOLUTION" is to be

read on Wednesday, 12th May, at 3 P.M. by ROBERT BRUCE, Esq. B. Sc., M. Inst C. E., M. Inst M & Cy E., Master of Works and City Engineer of the City of Glasgow. By courtesy of the Institute of Transport the reading will take place in the rooms of the Institute at 80 Portland Place, London W 1, admission being by invitation.

A list of those who have attended preliminary meetings leading to the formation of the group and those who have asked to be kept informed of its progress is also attached.

OBJECTS OF THE ROAD TRAFFIC STUDY GROUP

1. To collect, analyze and collate all available information conducive to the solution of the road traffic problem.
2. To extend the researches into traffic problems already undertaken, taking into account:
   (a) The influences bearing upon problems arising out of traffic (i) in motion and (ii) at rest.
   (b) The need to distinguish between recommendations practicable of application in three stages:
      (i) Short term (1 to 5 years)
      (ii) Intermediate term (5 to 10 years)
      (iii) Long term (10 years and over)
   (c) The interests of the individual, the local authority and the Nation.
3. To institute an organisation capable of affording co-operation and assistance to bodies studying ancillary problems.
4. To direct to appropriate specialist bodies, problems ancillary to the traffic problems.
5. To make available to bodies confronted with traffic problems, up to date information conducive to their solution.

MONTREAL STUDIES PARKING PROBLEM

An interesting and informative study of the parking habits and desires of business men of Montreal has been completed. Results were submitted by Howard M. Baker (Affil. ITE) on behalf of the Montreal Board of Trade.

Among the major recommendations were (1) Provision of municipal parking lots with driver parking at a cost of approximately 25c per day, (2) provision of underground parking with attendant parking at a cost of approximately 50c per day, (3) Consideration of deck type garages with the first two floors used for commercial businesses, (4) Better enforcement of curb parking regulations, and (5) Elimination of ticket fixing.

A few interesting findings include:

1. The average business man brings his car into the downtown area for business purposes, and he parks for 6 hours or more.

2. 71% think the city should provide off-street parking.

3. If provided by the city, 64% think a charge should be made.

4. 80% of drivers now park within two blocks of their destination; 90% would like to do so.

5. 6% of drivers expressed a willingness to walk three blocks or more, although 18% now do so.

6. 64% wish to pay 25c or less for all-day parking, 76% will not pay more than 35c.

7. 68% of drivers would not change to public transportation even if present service were improved.

8. 44% favored low-cost fringe parking with frequent shuttle service.

Reflectorized painting of no-passing zone markings on highways, recommended as a standard procedure by the American Association of State Highway Officials, has been adopted by Louisiana.

Skid Resistance

by TILTON E. SHELBURNE, *Director of Research*
AND
R. L. SHEPPE, *Associate Research Engineer*
Virginia Department of Highways

MORE THAN 1000 measurements of forward skidding distances on 32 pavement surfaces both in a dry and in a wet condition are reported. The purpose of the study was to obtain data on surface characteristics that could be used as a guide for establishing future design, construction, and maintenance policies. Both good and worn tread synthetic and natural rubber tires were employed.

Skid resistance measurements were made by the stopping distance method. A light-weight automobile equipped with 6.00 by 16 in. 4-ply tires was used throughout the study. The test car was a free-moving vehicle and not influenced by the same forces as a towed vehicle. On level sections of pavement the car was brought to an initial uniform speed of 10, 20, 30, and 40 mi. per hr. and the brakes applied instantly, locking all four wheels. At the instant of locking the wheels a detonator, attached to the running board and actuated electrically through the brake pedal, fired a chalk bullet on the pavement. The forward skidding, or stopping distance, was measured from the chalk mark to the gun after the car had stopped. Two or more measurements were made at each of the four speeds on a dry surface. The pavement was then sprinkled with water and the tests repeated. Results reported are average values for each condition.

Tests were conducted principally on high-type pavements on primary roads including bituminous concrete, sand asphalt, special plant-mix, rock asphalt, sand and slag seal treatments, broom drag treatment, Portland cement concrete, and glazed bituminous surfaces. Test sections were selected to permit an evaluation of different kinds of materials and methods of finishing. Tests were conducted on two-, three-, and four-lane pavements with traffic counts (24-hr. basis) ranging from 556 to 9401 vehicles. All but two tests however, were conducted on the outside lanes. Fourteen of the 32 surfaces were resurfaced concrete pavements.

Forward skidding distances increased with speed and were much longer on wet than on dry surfaces. At 40 mi. per hr., measurements ranged from 63.6 to 88.9 ft. on dry and 72.0 to 254.5 ft. on wet surfaces. The data indicated that at this maximum speed (40 mi. per hr.) forward stopping distances are critical only on the wet pavements. It was considered unsafe to conduct tests on a wet surface at greater speeds.

Twenty-seven of the 32 surfaces were found to have satisfactory non-skid characteristics in a wet condition. Those surfaces having a harsh, gritty, sandpaper-like texture were found to have short stopping distances and correspondingly high coefficients of friction. On the other hand, long stopping distances were measured on smooth glazed surfaces. From a safety standpoint broom-finished concrete pavement was far superior to the smooth or belt-finished surface.

Non-skid treatments were effective in reducing forward skidding distances on wet surfaces. In one instance at 40 mi. per hr. the stopping

NEW DEVELOPMENTS IN TRAFFIC ENGINEERING

Published in January, 1948, the "Report of the Traffic Engineering Committee" of the Joint Fact Finding Committee on Highways, Streets, and Bridges, presents a clear and concise picture of the traffic engineering needs for the state of Washington. The principles outlined in the report are capable of application in many areas.

Chapter I outlines under 12 captions the normal duties and functions of traffic engineering divisions. Other major chapter headings include such pertinent titles as: Design Elements of Roadways which affect operation; Making best use of existing facilities; Related functions of Engineering, Education, and Enforcement; Legislation related to operational functions; Standards for Roads and Street Operation; Organization and Administration; Off-Street Parking and Loading.

The material under each of these chapters is clearly presented, with frequent references to factual data to substantiate statements.

Four members of the *Institute of Traffic Engineers* served as engineering consultants to the Legislative Committee: G. Donald Kennedy, Grant Mickle, Carl Fritts and C. F. McCormack. Chairman of the Traffic Engineering Committee was Dave Morris (Member ITE), assisted by Arch Bollong (Member, ITE).

---

distance was reduced from 224 to 94.7 ft. At 40 mi. per hr. on wet surfaces stopping distances were about 40 per cent longer for worn than for good tread tires. Under comparable conditions stopping distances were about 12 per cent longer with smooth synthetic (S-3) than with smooth or worn tread pre-war natural rubber tires.

The stopping distance method was found to be a relatively simple, inexpensive, quick means of measuring skid resistance of pavement surfaces. Close check results were obtained.

Functions and Administration

A report bearing the above name has recently been published by the Public Administration Service, Chicago. Three national groups—the American Association of State Highway Officials, representing the Federal and State Highway Officials; the American Public Works Association, representing principally the city officials; and the *Institute of Traffic Engineers*, appointed a joint committee to prepare the report.

The report discusses trends in Highway Transportation, tracing the problem from its early "out-of-the-mind" stage to the present-day urban congestion situation. The growth of traffic volumes and of roadways are discussed and illustrated. The development of the automobile is discussed, and the third component part of the traffic problem—the human element—is examined in detail.

Under the chapter heading: Operation of Existing Facilities", are discussions of the more common traffic engineering applications, such as: speed zoning, turning regulations, one-way streets, unbalanced-flow regulation, routing, and parking.

An interesting part of the report deals with the administration of traffic engineering in state and city governments. Organization charts are included, showing functions of a state traffic engineering division as well as the position of traffic engineering activities in the highway organizations of the states of California, Massachusetts, Michigan, Ohio, and Wisconsin. Three functional organizational charts illustrate the position and duties of a traffic engineering department in cities of three sizes: less than 50,000 population: from 50,000 to 100,000; and in cities of more than 100,000 population.

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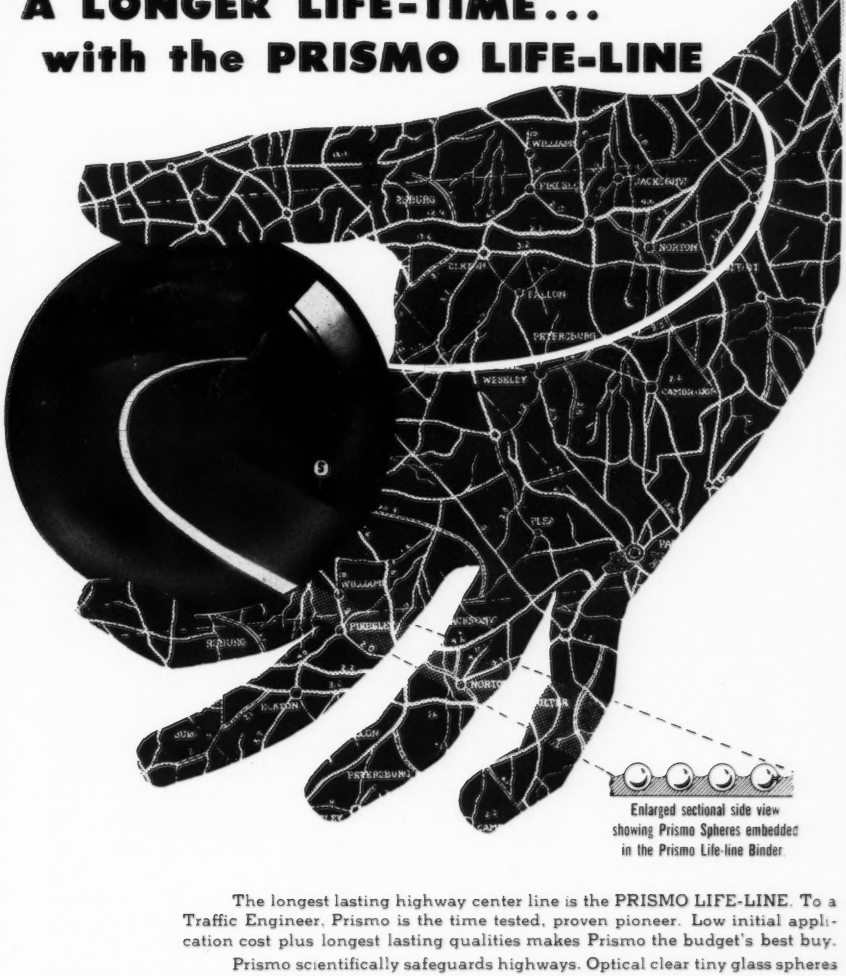

Enlarged sectional side view showing Prismo Spheres embedded in the Prismo Life-line Binder.

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THE PRISMO SAFETY CORPORATION
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COMPLAINTS COVERING MOTOR BUS OPERATIONS

Several New Jersey *police chiefs* have made a poll of the personnel in their departments asking for complaints regarding bus operations. Items that deserved discussion are listed below:

1. Speedometers should be on all buses and kept in working order.
2. Careless driving of buses should be reduced and reckless drivers should not be protected by the companies but rather disciplined when they are apprehended and summoned.
3. Schedules should be adjusted to prevent speeding even to reducing layover time. Bus drivers have been called "cowboys" in some places.
4. Buses must slow down in crowded districts, school districts and when there is a large foreign-born population.
5. Buses should not overtake and pass each other except when one is loading and unloading. This is hazardous and blocks other traffic in business districts. More respect should be given to the rights of other highway users and a better knowledge should be gained of bus operators' rights and obligations in the use of the streets.
6. There seems to be a need for having better rules explaining to the drivers what they should do in case of accidents. Instructions should be to stay in case of accident and render aid.
7. Buses should stop before crossing a frequently used rail freight line.
8. All buses should be fitted with fire fighting equipment.
9. More and better indications of routes should be placed on buses, perhaps by placing a card in the back of the bus to show what route it is. This saves people from running out into traffic to see if it is their bus.
10. Buses should pull into the curbs and not block traffic. Even where adequate bus stops are provided, drivers say that schedules cannot be maintained if they pull to the curb as required.
11. Drivers fail to indicate by either mechanical or manual means whether they are pulling in or out of stops.
12. Buses should pull off highways when stopping on state and county routes.
13. Stop angling buses on one-way streets.
14. Pick up and discharge passengers only at designated stops.
15. Reduce the number of stops in congested areas.
16. Locate stops better in relation to traffic signals, pedestrian movements and needs of passengers and you will have less delays.
17. Instruct your drivers not to pass up people and leave them standing when schedules are behind if you want people to keep on using your service.
18. Omit layovers of buses in business districts.
19. Stop overloading your vehicles.
20. Regulate the number of standees.
21. Speed up loading procedures.
22. Reduce overlapping routes.
23. Operators are not generally discourteous, but sometimes inconsiderate. Drivers going in opposite directions stop in the street and block traffic just to chat. They also delay loading and unloading by arguing with passengers while making change. Some drivers stop to have a cup of coffee and leave passengers waiting in the buses.
24. Operators are careless about smoking in buses, often violating the

(See COMPLAINTS, *page 539)*

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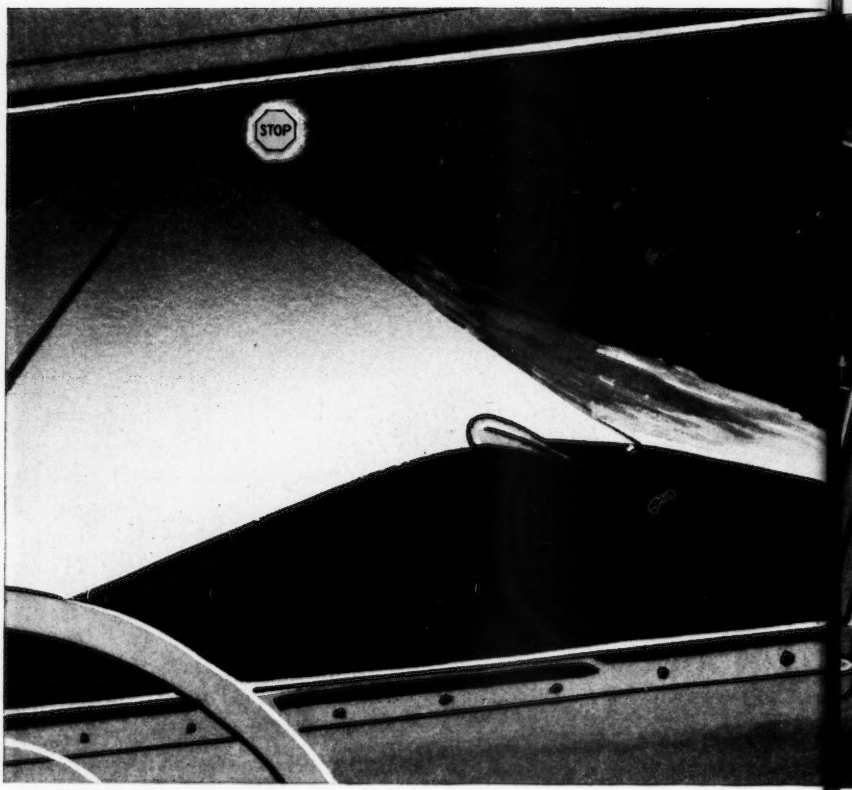

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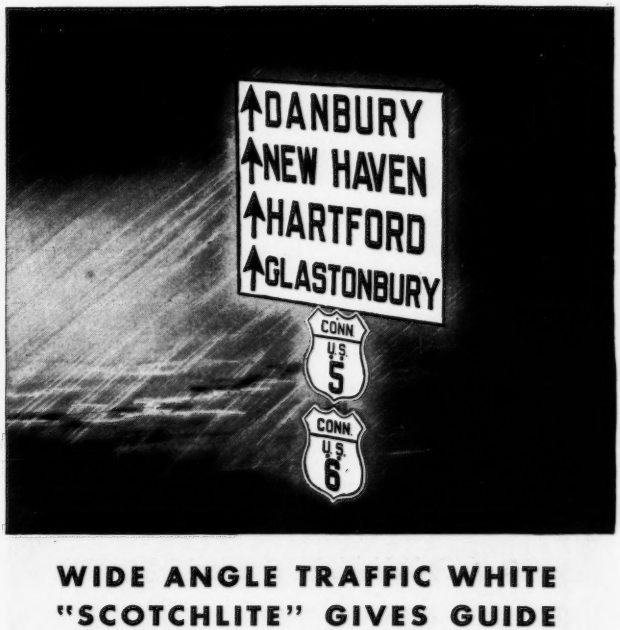
Make sure your traffic signs are keeping pace with modern roads, modern speeds—give them extra brilliance and effectiveness with "SCOTCHLITE."

Complete information on Wide Angle Traffic Yellow or White "SCOTCHLITE" is yours for the asking. Just drop a line to Department TE88.



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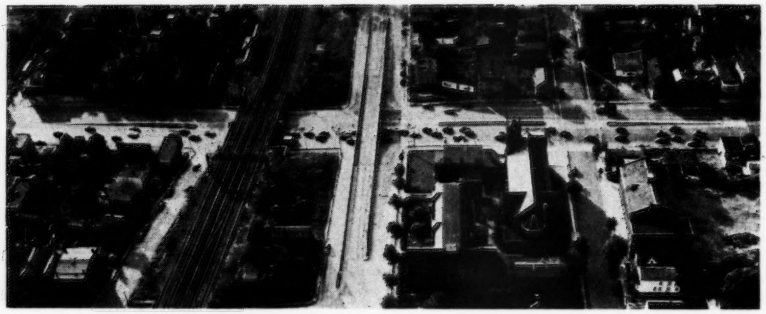


Above: View of railroad and highway separation structures at Elizabeth, N. J., on U. S. 1.

—Public Roads Photo

ON THE SHELF

Valuable to civic groups, railroad and public officials interested in public safety, is a new 24-page booklet, "Grade Crossing Safety is Your Business", issued by The Western Railroad Supply Company, maker of Model 10 Automatic highway crossing signals.

Profusely illustrated, the booklet traces the evolution of grade crossing protection from the early days of railroading up to the present time. The ten common causes of grade crossing accidents, as listed by The National Safety Council, are discussed and illustrated graphically with drawings of actual cases, reproduced by permission of the Council. An authoritative article by Alfred A. Benesch, consulting engineer, treats realistically of the grade crossing menace and its solution. Grade separation, costs and advantages, are pitted against modern grade crossing protective devices in order to determine maximum protection for the investment made.

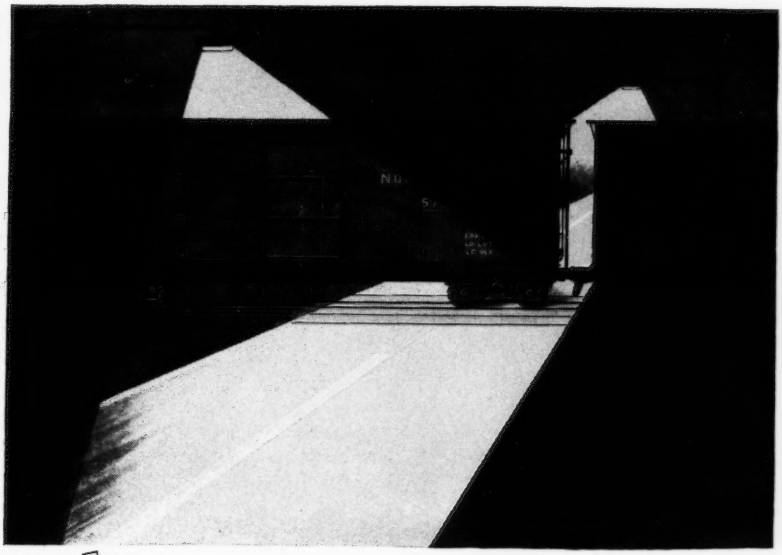
Municipal Garage Opened

In most communities they talk a good solution to the parking problem; in Bluefield, West Virginia, they took action.

On June 18, with suitable pomp and ceremony, Bluefield's half-million dollar municipally financed and operated open-deck parking garage was formally opened to the public. The garage, started in 1946, has a capacity of 800 cars, in approximately 250 by 200 feet and has four parking floors.

An area of over 46,000 square feet, almost in the heart of the city, was purchased for $114,000. Cost of the building was $397,000 and financing was through revenue bond issue.

The structure is so designed that at some future date a huge municipal auditorium can be constructed on top of it. Slope of the streets surrounding the building is such that even though the auditorium would be on the top floor it would have a street entrance.



HOW TO LIGHT A GRADE CROSSING

There's no better way to light a railroad grade crossing than with sodium lamps.

Sodium lighting with its distinctive yellow color provides high visibility and at the same time warns drivers that they are approaching a hazard. Properly positioned these lamps will show up, by silhouetting, any train crossing the highway—preventing cars from crashing into the side of standing or moving freight trains, an all too common form of accident.

General Electric has had broad experience in helping traffic engineers with lighting problems. For railroad grade crossings or underpasses—for bridges, hazardous intersections, traffic routes—for better safety at night—let a G-E lighting specialist help you put the right light in the best place. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

452-74

TRANSIT-PARKING FACILITIES

by I. S. SHATTUCK *(Mem. ITE)*

Editor's Note: Author Shattuck has asked that if readers know of cases which he has not reported they get in touch with him.

Denver, Colorado. (Infor. from Henry Barnes, Traffic Engineer)

Some 3 or 4 years ago several downtown stores contacted the Tramway Company relative to transit-parking operations, but, analysis proving it to be not a paying proposition, the company dropped the idea. A deal was made with a private individual who operated station wagons. This was found uneconomic and the stores took over the operation. This was soon discontinued.

Detroit, Michigan. (Infor. from Fred C. Taylor, Ch. Eng'r., Dept. of Street Railways)

Several fringe parking lots with shuttle buses downtown were operated by the department before the war. These were discontinued during the war in compliance with ODT regulations and have not been resumed. Some were financially successful, principally, however because of the volume of "on-off" business enroute. In study of possibility of resuming operations it was concluded that it would be uneconomic without substantial "on-off" business unless parking facilities were very large and filled to capacity.

San Diego, Calif. (Infor. from S. E. Mason, Pres., S. Diego Elec. Ry. Co.)

Although special facilities are not operated, the company has long made a practice of suggesting in advertisement that people park along bus and car lines and ride downtown. (The results evidently have been fairly good.)

Grand Rapids, Michigan. (Infor. from Grand Rapids Motor Coach Co.)

City-subsidized bus service between two city parking lots ¼ to ½ mile outside downtown district and the downtown district was tried. A bus loop was operated on a 30-minute headway with a 20c fare (evidently for both ways and included parking charge). Service was inaugurated in 1946 but was abandoned some time later because of lack of patronage (due, no doubt, to the inconvenience of a 30-minute headway on a loop operation).

Pittsburgh, Pa. (Infor. from C. W. Wilson, Res. Mgr., Pitts. Rys. Co., Dr.)

Many years ago there was a trial operation by the company to a single parking lot. Parking tickets, including transit fare to downtown, were used. This lasted only a few months.

Atlanta, Ga. (Infor. from R. R. Edwards, Ass't to Transportation Mgr., Georgia Power Co.)

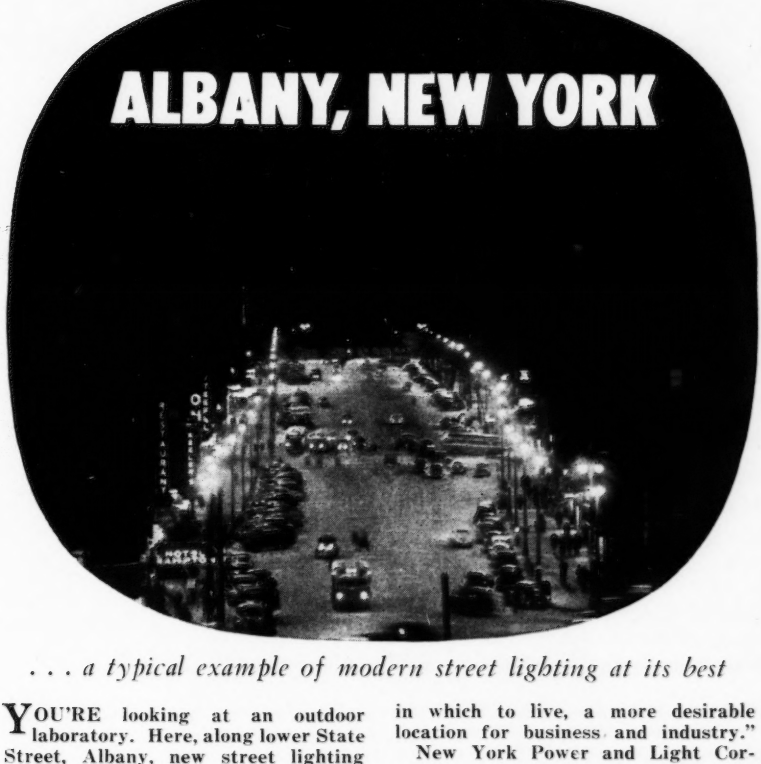
The following operation was discontinued in October 1947, due to poor patronage:

Rich's department store subsidized bus service between the store and a fringe lot of 750 capacity 1.02 miles distant. Two buses on a 10 minute headway were operated.

Norfolk, Va. (Infor. from W. R. Pollard, Pres., Virginia Transit Co.)

For 3 months in 1947 the company furnished special bus service, subsidized by retail merchants, to a city parking lot. 10c was charged for both parking and bus fare.

ALBANY, NEW YORK



. . . a typical example of modern street lighting at its best

YOU'RE looking at an outdoor laboratory. Here, along lower State Street, Albany, new street lighting methods and equipment are being tried under tougher-than-usual conditions—to determine the best way of relighting the whole city.

State Street is one of Albany's main business arteries as well as a heavily traveled thoroughfare. Its width varies from 76 to 102 feet.

The new installation consists of 15,000-lumen multiple group-replacement filament lamps mounted in pairs, 30 feet high, parallel to the curb. The spacing of the tapered steel posts varies from 76 to 88 feet in opposite arrangement. Average illumination is 2.72 to 2.86 foot candles.

Said Mayor Erastus Corning, II, when the lights were turned on: "Good lighting makes the city a better place in which to live, a more desirable location for business and industry."

New York Power and Light Corporation, the progressive utility that worked with municipal officials to bring about these improvements, is a staunch believer in street lighting's benefits.

In Albany, as in other communities served by this organization, all due credit is given street lighting for its life-saving qualities. But its other benefits are stressed, too—the fact that it aids business, attracts new industries, increases real estate values and bolsters civic pride. Its noteworthy demonstration in Albany deserves careful study by all towns and cities.

FREE BULLETIN — If you would like additional interesting street lighting facts on still another progressive city, send for your copy of "The Indianapolis Story."

The Street and Traffic Safety Lighting Bureau, 155 East 44th Street, New York 17, N. Y.

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IDEAL FOR COUNTY HIGHWAY CENTERLINE MARKING

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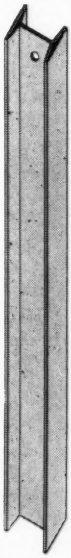

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Activities . . . .

SECRETARY'S COLUMN

In a newsletter to all members of the *Institute*, dated June 14, 1948, your Executive Secretary promised to report in this issue on the Board of Direction meeting held recently in Columbia, Missouri. Seven members of the Board were on hand from widely scattered points. Vice-President Smith and Director Dorsey represented the extreme East and West coasts respectively, while Directors Osborne and Brandes came from Northern and Southern extremities of the continent. Other Board members present were Harry E. Neal, vice-president, presiding; D. Grant Mickle and immediate Past President Seburn, official host. The University of Missouri outdid itself to provide a swank board room, and through the offices of the Director of Adult Education and Extension Service, Amos J. Snider provided excellent secretarial assistance in transcribing the minutes of the meeting.

Your Executive Secretary's report included a review of Institute affairs mentioned in the June 14th newsletter and the following items: (1) Traffic Engineering Handbook revision only one-half complete, with the Annual Meeting in October the deadline for completion of all chapters; (2) results of National Traffic Safety Contest showing ITE members controlling majority of top ten cities in all groups; (3) recognition of ITE in the 1948 Engineering Societies' Yearbook for the first time; (4) status of membership applications showing 100 outstanding, in addition to those to be acted upon; (5) statement showing sound financial status, despite lack of anticipated contributions; and (6) a summary of activities of local sections, student chapters and committees.

By board resolution, additional changes in the Constitution and By-Laws relative to Government were approved for submittal to the membership prior to the Annual Meeting. The Board also made a decision to submit a suggested Code of Ethics to the membership for vote on adoption at the Annual Meeting, thus allowing a majority of the membership to make the decision on this vital matter. The progress report of the Special Codification Committee was presented by Tom Seburn in the absence of Mr. Cherniack. This report indicated that the committee was prepared to make recommendations for drastic changes in ITE committee structure at the Annual Meeting. The Board also decided to begin a study of equitable geographical representation of Board members—initial investigation to be made by the Executive Secretary. Many other important matters relating to the welfare and continued expansion of the Institute were discussed and decisions made—many of which will be reported later. The Board acted favorably on 15 new membership applications, making a total of 421 members to date. With the many applications outstanding it may still be possible to reach the 500 mark by the end of the calendar year. However, the Board continues to act on membership applications with impartial and considered judgment, and no new

members are elected who do not meet with the approval of a majority of the Membership Committee and the Board, and who do not meet the qualification standards of a Traffic Engineer as detailed in the Constitution and By-Laws. The Board wishes it to be known that although they are desirous of increasing the membership as rapidly as possible in order to again become self-supporting, they have no intentions of "softening up" or letting the minimum qualification bars down for that reason.

ROBERT S. HOLMES

I T E PERSONALS

RALPH DORSEY, GLEN SMOOT and **JOE HAVENNER** were among those participating in the program of the Tenth Annual Western Safety Conference held in Hollywood. **ARCH BOLLONG** was scheduled to appear on the program but could not make it due to illness.

WIN CARSTEN rounded up **E. E. LEWARCH, GEORGE HOWIE, ARCH BOLLONG, DAVE MORRIS, JOHN SCHMIDT** and **NORM KENNEDY** last month and held an ITE area meeting in Tacoma.

J. W. ARCH BOLLONG and associates announce the establishment of a traffic and transportation consulting service for the purpose of engaging in street and highway traffic consulting work and general highway transport engineering in the Eleven Western States. This traffic consulting department is headed by J. W. Arch Bollong, who is known throughout the United States and who has had twenty-four years' experience in traffic engineering, control, facilitation and proven traffic control and safety methods.

Following is a partial list of the subjects on which the consultant is qualified to give advice, service and application, and by means of which a city, state, individual or community will positively be able to solve modern traffic problems:

1. Preparation of model traffic ordinance for municipalities, based upon national standards and model traffic ordinance.
2. Accident location files.
3. Operators' file accidents and violations record.
4. Accident spot maps.
5. Accident collision, condition and flow diagram.
6. Recommendations for accident remedies.
7. Modern traffic safety lighting.
8. Traffic bureau organization.
9. Traffic Training—Police and Engineers' Training School.
10. Traffic patrol route and time layouts.
11. Selective enforcement.
12. Enforcement budget.
13. Enforcement maps.
14. Traffic problem analysis at specific locations.
15. Vehicle equipment testing stations—design and use.
16. Investigation and reports on major traffic accidents and catastrophes.
17. Investigations and reports on particularly hazardous roads or locations.
18. Street, road and intersection designs.
19. Traffic control signal layouts.
20. Speed control problems.
21. Traffic sign and signal problems—standardizations.
22. Pedestrian problems.
23. Traffic improvement programs.
24. Traffic violations studies and reports.
25. Traffic violations bureau organization.
26. Channelization.
27. Street usage.
28. Traffic Signal design, layout and installation.
29. Freeway planning.
30. Origin and Destination Studies
31. Traffic congestion relief.
32. Advice on traffic regulations.
33. Parking studies, reports and regulations.
34. Safety educational problems.
35. Advice on Drivers' Schools and license requirements.
36. Traffic routing investigations and reports.
37. Trucking and stage studies on city streets and rural highways.
38. Cordon counts.
39. Parking (on and off-street) solutions and facilities.

Traffic Surveys

In addition to the above, the consultant is prepared to undertake the following types of more comprehensive work for private organizations:

(a) Mass transportation companies (routing, congestion relief, safety studies, stops—skip and far side).

(b) Amusement areas (theaters, ball parks, football stadiums) traffic control and parking studies.

(c) Real estate companies (traffic desirability studies for various properties) trends as to future locations.

(d) Oil companies (trade area and traffic flow charts—station location studies) now and future.

(e) Outdoor advertising (traffic studies, audits, locations and visibility).

New Type of Personal Service

It is realized that some communities and cities have full-time traffic engineers and others have a man either in the police department or engineering department charged with the responsibility of traffic control. Cities which can afford full-time traffic engineers probably do not need the services of a traffic consultant except in special cases. Men who have had traffic duties added to their other responsibilities would undoubtedly welcome the traffic consultant to advise on constantly arising traffic problems. The consultant feels he can be of real service to that group of cities having no traffic engineer, as well as to the many private organizations and firms whose activities could be increased through consultation with a traffic advisor. To discuss the seriousness of the traffic and accident problem existing in practically every community is needless. It will suffice to glance at the accident rate in your particular community, traffic congestion and parking headaches, which are climbing year by year, to realize that steps must be taken from a fact-finding standpoint to correct the conditions which now exist.

SECTION NEWS

WESTERN SECTION

An area meeting of the WESTERN SECTION of the INSTITUTE was held at the Hollywood Roosevelt Hotel on June 17th in conjunction with the Tenth Annual Western Safety Conference. Nick Carter, President of the Western Section, presided. Twelve members and fourteen guests were present at the meeting. A general discussion was held regarding the activities of the Western Section. The group went on record recommending that the annual meeting of the Western Section be held in San Francisco later in the year, at a time when maximum attendance could be expected. Ralph Dorsey was instructed to obtain an expression of opinion at the next Board of Directors meeting of the Institute as to how far the Western Section and its area groups can go in listing recommended and approved consulting traffic engineers. GLEN SMOOT, just back from a meeting of the Midwest Section, conveyed their greetings to the Western Section. The group unanimously favored holding regular monthly area meetings until such time as the membership warrants a further division of the WESTERN SECTION.

The Nominating Committee has submitted the names of Arch Bollong for President, J. A. Czizek for Vice-President, and Joe Havenner for Secretary-Treasurer.

We are looking for a man, 25-45 years of age, with at least three years of experience in traffic engineering. Residence requirements have been waived, but he must be a United States citizen. A degree in engineering and eligibility for registration as a professional engineer in Ohio are required. The entrance salary is $4798.00, the maximum is $5518.00.

Applications may be obtained from the Civil Service Commission, 260 City Hall, Cincinnati 2.

W. D. HEISEL
Asst. Personnel Officer
City of Cincinnati
260 City Hall

19th Annual Meeting
INSTITUTE OF TRAFFIC ENGINEERS
Philadelphia, Oct. 11, 12 and 13, 1948

Position as Traffic Engineer for young graduate engineer with special training or experience in traffic engineering. Civil service examination necessary. For details write to San Diego County Personnel Director, Civic Center Building, San Diego, California, or to **Western ITE.**

LETTERS TO THE EDITOR

The Editor,
TRAFFIC ENGINEERING,
2312 North Vernon,
Arlington, Virginia.

Dear Mr. Editor:

I beg to refer to the article on "The International Sign System" in the November 1947 issue.

Regarding the Danger Signs shown in Table I, it seems to me that the pictures are not quite correct: As to the best of my knowledge, all these signs should have a red frame similar to that used for the signs shown in Table II, it is 80 to 120 millimetre broad according to the height of the sign.

These signs are rather generally in use in central and western Europe. The sign No. 8 of Table I is sometimes used as STOP sign before major road intersections, the word HALT being painted inside the triangular on yellow ground.

An interesting use is being made of the signs Nos. 4 and 5 protecting railway level crossings:

The signs are mounted on beacons as shown in the drawings Nos. 1 and 2 at the enclosed sheet, and are being followed by another beacon as shown in the drawings Nos. 3 and 4. The first sign bearing the international signs Nos. 4 and 5 are being placed at a distance of about 240 metres before the crossing, the next beacon bearing two diagonal stripes about 160 and the last one bearing one diagonal stripe about 80 metres before the crossing. All red painted parts bear, of course, red reflectors. The final arrangement is shown in drawing No. 5.

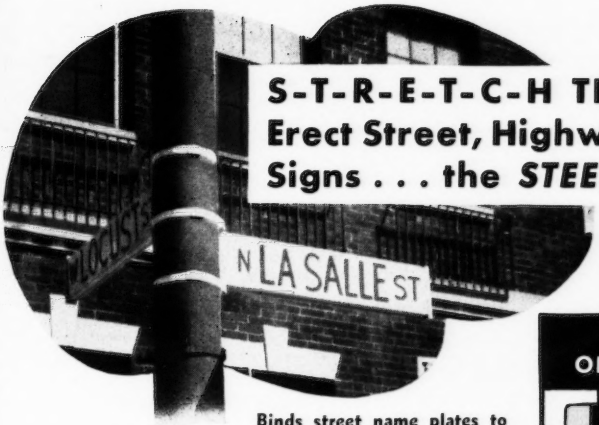
W. A. FRAENKEL,
Traffic Engineer,
70 Hayarkon Street,
Tel-Aviv,
Palestine.

Word has just come through that two more members of the Florida Section have become registered Professional Engineers in this State. They are Robert N. Grunow and Theodore M. Vanderstempel, who took the exam in May.

This increases the total number of Registered Engineers in our Florida Section membership to five, the others being Edmund Friedman, Walter M. Parker, and myself.

It is rather interesting that the three officers—Grunow, Vanderstempel, and myself—are all registered. I thought you would be interested in this information and you may want to pass on to Traffic Engineering magazine the fact that Grunow and Vanderstempel have recently been added.

EARL J. REEDER



Binds street name plates to steel and concrete standards

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COST drops, signs look trim and stay put when erected with a Steelbinder Tool and stout, corrosion resistant strap. Maintenance men like the easy way Steelbinders strap on the sign, even in cold weather, and the work saved when the sign is removed. Cement or steel standard, round, square, or irregular shape, plain or fluted surface, the Steelbinder method provides a permanent, trim looking sign mounting, saves work and material, and eases the strain on your budget dollar.

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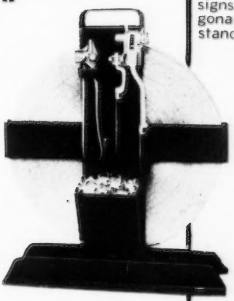
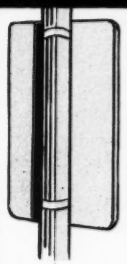
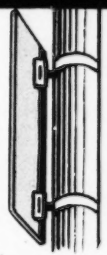


HOLDS FAST ON ANY SURFACE

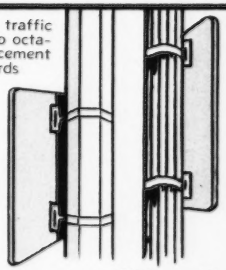


Binds traffic signs to small diameter steel standards



Binds traffic signs to smooth, round steel poles

Binds traffic signs to octagonal cement standards



Binds traffic signs to fluted cement standards

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Tell me more about the Steelbinder way to fasten traffic signs and street name plates on poles.

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INCREASE EFFORT FOR SAFETY ON HIGHWAYS

Proof of effectiveness is in results achieved, and on this basis the nation as a whole can be said to be making good progress in attaining goals of the Action Program for traffic safety. But a measure of the work still to be done makes it equally clear that many gaps must be filled and activities stepped up in states and cities if we are to protect our gains and make further progress against accidents.

This, in brief, is a summation of conclusions reached at a recent meeting of the Committee on Conference Reports of the President's Highway Safety Conference after a study of state and city reports for 1947 in the National Traffic Safety Contests, the Pedestrian Protection Contest and the data submitted by states in the High School Driver Education Award Program. Findings and recommendations have been compiled by the committee, under the chairmanship of Thomas H. MacDonald, U. S. Commissioner of Public Roads, for early publication of a national progress report.

That progress in the last year has been real and substantial is seen in the fact that deaths by motor vehicle accident in 1947 were reduced to 32,000, compared with the 1946 death toll of 33,400. The death rate, or the number of fatalities per 100 million miles of vehicle travel, was dropped from 9.9 in 1946 to 8.6 in 1947, then reduced even further to 7.7 in the first quarter of 1948.

These reductions in death totals and rates were accomplished despite substantial increases in motor vehicle registrations and travel mileage; proof that the Action Program can be and is effective when vigorously and intelligently applied.

Definite need is shown for more widespread and more complete application of the Action Program. Some states and many communities did not share in the national reduction of the accident death rate. The highest state death rates last year were four times the lowest. In general, the committee found, the states which most vigorously applied principles of the Action Program had the best traffic safety records.

Law and Ordinances

In studying progress in laws and ordinances, the committee found that 16 states have strengthened driver license laws and that only one state now lacks such legislation. Yet 18 states still lack basic certificate of title laws, as recommended by the Uniform Vehicle Code, and 10 have no safety responsibility statutes. Reporting of accidents is still incomplete, especially among the states, and processing of records is inadequate.

Education

Big gains have been reported in high school driver training, teacher education, school transportation, training of traffic personnel and in other aspects of the education program. For instance, 170 teacher training courses on safety were held in 1947. Still much remains to be done in education. Less than 15 per cent of boys and girls eligible for high school driver training are receiving it; and only 59 per cent of the schools in communities under 10,000 population have safety patrols in operation.

Enforcement

Thirty-eight states engaged additional officers in the past year and 34 states increased police personnel assigned to traffic. Only 15 states, however, have 75 or more traffic officers per billion rural vehicle miles, the recommended standard. Thirty one states increased police training; yet

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Don't be satisfied with material of low reflecting intensity that requires frequent replacement.

Safety demands reflectors of extremely high reflecting power.

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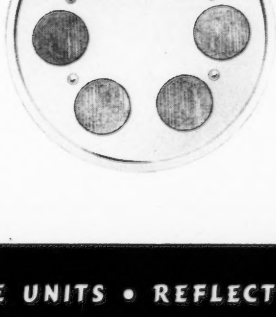
These Grote units are equipped with Grotelite prismatic reflectors, precision molded from shatter-resisting Plexiglas. The total refraction optical principle insures brilliant reflecting efficiency at long or short instances. Grotelite reflectors do not black out in fog or rain. Housings for all units are fabricated from heavy gage rust resisting steel, finished in baked enamel.

Standardize on Grote for Safety and Economy.



STREET NAME UNITS • REFLECTOR BUTTONS

THE GROTE MANUFACTURING CO., INC., BELLEVUE, KY.

training is negligible in some states and non-existent in others. Many cities are not meeting minimum training requirements. There is need for coordination between police and driver license administrators; and for uniform enforcement policies.

Twelve states have undertaken special studies toward revising the structure of rural traffic courts. In general, the courts need better trained personnel, wider use of scientific methods and closer coordination with other enforcement agencies.

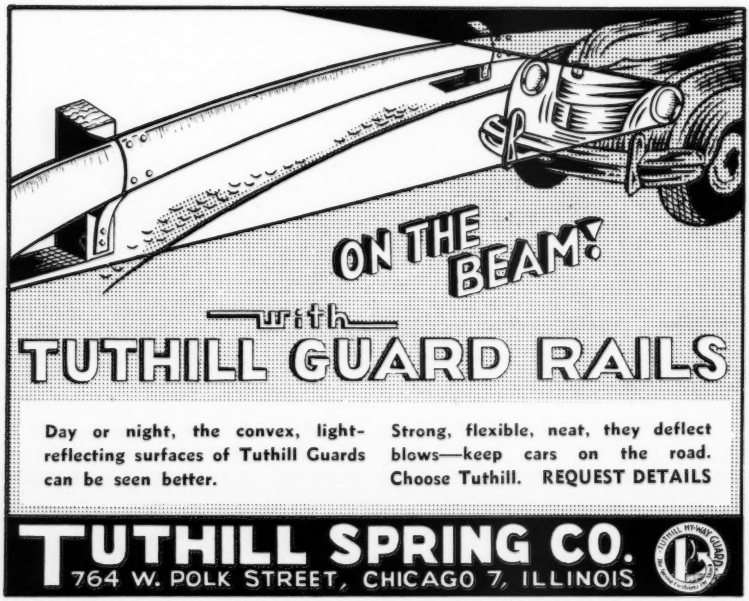
Engineering

Safer motor vehicles and tires with improvement of roads including construction of 103 miles of controlled-access expressways highlighted progress in engineering. Contracts last year totaled nearly $1 billion for new and safer highways. But the task is only started. Among pressing needs cited by the committee are more effective working relationships between state and city engineers; selective treatment of high-frequency accident locations; and assignment of more personnel to traffic operations and control.

Motor Vehicle Administration

In 45 states last year 417,500 drivers' licenses were revoked or suspended under mandatory provisions of the law, compared to 318,000 in 1946. This reflects an accelerated program in the field of motor vehicle administration. Wide disparity among the states is shown, however, in the fact that in one state only a small fraction of one per cent of the applicants

(See SAFETY, *page 540)*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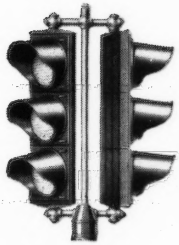
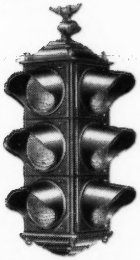


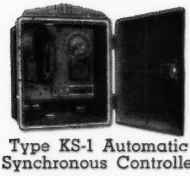
Type TRP-223D

Two-way, Three-section Adjustable Signal For Post Top Mounting



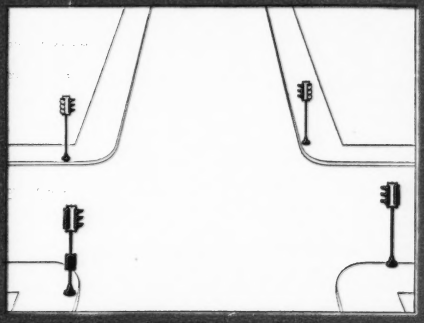
Type TSW-443D

Four-way, Three-section Non-Adjustable Signal For Mounting on a Span Wire

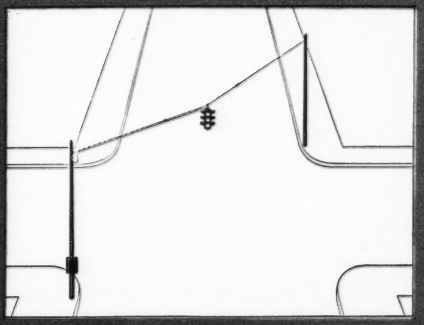


Type KS-1 Automatic Synchronous Controller

Six Signal Circuits — 4 to 16 Intervals.



Typical Installation of TRP-223D Two-Way Post Mounted Signal



Typical Installation of TSW-443D Span-Wire Signal

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Personalities . . . .

Although born in the Badger state, Bill Eliot is by inheritance and nature a Westerner. He was reared and educated in Portland, Oregon, where he graduated from Reed College in 1919. His academic career was interrupted for some months for service with Uncle Sam during World War I. After some time at San Francisco's Presidio and the State College of Washington, in the course of which he acquired the gilded bars of a Second Lieutenant, he returned to private life and resumed his academic career.

Following World War I, Bill came East to matriculate in the graduate school at Harvard University where he spent three years preparing himself to become an economist. He spent two years teaching at Wesleyan University in Connecticut, followed by a year of graduate study at the Brookings Graduate School in Washington. Thus with the sheepskin of a Ph.D. practically in hand, and the assurance of a quiet professional career, he "slipped" temporarily into the transportation field as assistant highway economist with the then Bureau of Public Roads. The motivating force, he tells us, was the need for an immediate stipend.

This supposedly temporary detour from academic life has stretched unbroken for 23 years to date.

Mr. Eliot was introduced, professionally, to traffic engineering through the Ohio Traffic Survey of 1925, an early forerunner of present highway

(See ELIOT, *page 540)*

Jim Burch was born, reared and educated in North Carolina. He was graduated in engineering from Duke University when it was Trinity College, which may or may not tell you how old he is.

Like many of his fellow associates in traffic engineering, he got his start in the professional world as an instrument man with a private company in Lenoir County, North Carolina. From there he went with the State Highway Commission where for seven years he was resident engineer and claims adjuster.

Jim Burch's ability as an engineer technician came to the attention of the American Road Builder's Association and in 1929 he went to Washington on the engineering research staff of ARBA. Still in the highway construction field, Jim left the road builders to become research engineer of the Wire Reinforcement Institute with headquarters in Washington. With contacts in Washington and the coming of the National Recovery Administration, Mr. Burch became an NRA engineer of construction materials.

From Washington Jim migrated to Chicago—as executive secretary and treasurer of the National Corrugated Pipe Association.

But the lure of the Dogwood in his native "Tar Heel" state was too great, so in 1936 Jim returned, this time to the State Highway and Public Works Commission as engineer of statistics and planning where he has

remained and made an outstanding record. He has had charge of the highway planning survey not only in its technical direction but has had much to do with the practical application of results during recent years.

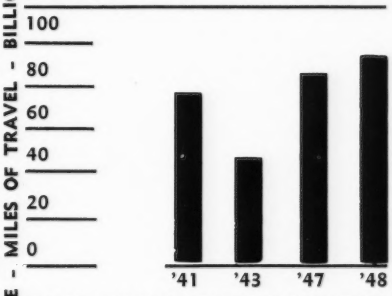
He had charge of external origin-destination surveys in ten North Carolina cities. Under his supervision there has just been completed a comprehensive parking survey for Charlotte made cooperatively with the city and the federal government.

Like many others of our ITEers, Jim's innate modesty doesn't permit him to brag about his golf game or his prowess with rod and reel, and he says he can't afford to play North Carolina poker. Much of his spare time is very profitably spent on activities of an eleven-county Boy Scout Council, the latest project of which is the construction of a fine camp. The connection between Jim's scouting and family activities is slightly remote inasmuch as he is the father of two lovely daughters.

He is also a church elder, which at least at this time is the church's good fortune for his engineering talents are being tapped in connection with the design and construction of a new building. He shares with his wife the family honors at bridge.

Max Ball, director of the Interior Department's oil and gas division, said the gasoline supply "looks pretty good" for summer and fall. He expected nothing more than spot shortages to develop, and that these would develop only due to distribution difficulties.

TRAFFIC TRENDS



TRAVEL ON RURAL ROADS FOR FIRST SIX MONTHS OF 1941, 1943, 1947 AND 1948.

(COMPLAINTS, *from page 518*)

"No Smoking" rules themselves. Prominent cards should be displayed for passengers, and drivers should be instructed in polite ways to gain the passenger's compliance. A drive should be put on if the situation is bad, preceded by several weeks of advertising and then plain clothes officers should be stationed on buses for a period. Adequate legislation is required. The sanitary code could be amended and mandatory fines imposed.

25. Buses should use chains in snowy weather and possibly be fitted with sanding devices.
26. The New Jersey Motor Bus Association could very well set up a Maintenance Division and a Driver Training Program.
27. County-wide Traffic and Transit Coordinating Committees should be formed to deal with these problems.

Fatal traffic accidents after dark are reduced an average of 76 per cent by modernizing street lighting, according to studies of 11 localities by The Street and Traffic Safety Lighting Bureau.

(ELIOT, *Cont. from page 538)*

planning surveys. He carried out a variety of assignments including traffic safety research, traffic capacity studies and traffic control standardization work. He is credited with using for the first time a graphic time recorder in highway traffic capacity studies, which is the basis of many elaborate instruments since developed by the U. S. Public Roads Administration and others for analyzing traffic behavior.

Bill Eliot is best remembered by many fellow ITE members as "Mr. Manual-on-Uniform-Traffic-Control-Devices." He first served as a member of the National Conference on Street and Highway Safety in 1930, served again in 1934, and has since been active in its Committee on Uniform Traffic Laws and Ordinances. For over 10 years he has contributed to the work of the Joint Committee on Uniform Control Devices, of which he is now secretary, and is nursing the new Manual through to early publication.

He doesn't know just how far he missed being a charter member of the Institute, but he joined in 1932 when ITE was a small, but lusty infant. He was the first secretary of the Washington Section and later served as its president.

Three years ago, he tells us he received his highway engineering degree by brevet of the U. S. Civil Service Commission. The Commission, it seems, decided that only a highway engineer could qualify for the job Bill had held for 20 years. So they "graduated" him.

In private life, Mr. Eliot is married and has a daughter in junior high school and a son in elementary school. No hobby has enslaved him, but he admits playing around with photography a bit. It is rumored that he is building, in his basement, a sailing skiff for use at his summer place on the Chesapeake Bay. A delegation has already been appointed to measure the skiff and the basement door and report its findings.

One of Bill's earliest encounters with traffic problems was during a trans-continental trip by model "T"—which perhaps influenced him at the time to become an economist. In at least one city, he tells us, the speed limit was five miles per hour, and eight miles per hour was common in many eastern communities.

(SAFETY, *Cont. from page 536)*

taking their first driving test were failed, while in other states failures ranged as high as 64 per cent.

Among primary needs in this field is the need for closer coordination of official safety programs among the states, and among all departments of state government having jurisdiction over drivers, vehicles and roads.

Public Information

The public information program made good gains in the last year, notably in the attention given by press and radio to the highway safety problem, although in this activity as in the others, the situation is spotty and much needs to be done. The chief obstacle so far has been lack of trained personnel to process materials for use by mass information media, and to put the job on a continuing day-to-day basis. In more than 1,000 cities and in all the states, the number of full-time public information personnel is estimated to be not more than 700.

Public Support

Since 1946, a majority of states and many communities have organized public support agencies. Today 33 states have coordinating committees and 23 have state-wide support

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• IF YOURS IS AN Obsolete INSTALLATION

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YOU ASSUME NO OBLIGATION . . .
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ACCIDENT PRONE MILEAGE IN OHIO

During 1947, a total of 17,431 traffic accidents were reported on Ohio state highways outside municipalities. With approximately 16,000 miles of state highways outside of cities, this represents only 1.1 accidents per mile annually. Of course, the distribution of these accidents is not uniform; variations in traffic flow and physical differences such as character and width of roadway are factors which greatly influence the accident frequency.

In general, it may be assumed that a direct relation exists between the frequency of accidents and the amount of highway use, which may be expressed as a rate per million miles of annual travel. While other factors may have a direct bearing on the accident experience of a particular section of highway, these factors if present, will be reflected in the accident rate or index of sections with similar travel characteristics.

On rural state highways during 1947, travel in terms of vehicle miles was estimated to be 6,806,700,000 miles. On this basis, the accident rate for the rural state highway system was 2.6 accidents per million vehicle miles (computed by dividing reported accidents by annual vehicle miles in millions). While an accident rate computed in this manner does not seem unusually large, it must be remembered that each mile of highway with a 24-hour traffic flow of 2700 vehicles will aggregate a million miles of travel during the year.

Accident rates were computed for all sections of the rural state highway system, based on reported accidents and highway travel of each section. Sections included in this survey were generally those having a rate of better than 4.0 accidents per mile or per million vehicle miles. Sections with one rate lower than 4.0 were included only if the other rate was exceptionally high. However, all sections included were above the state average of 2.6 accidents per million vehicle miles and 1.1 accidents per mile of highway.

Summaries of all sections having accident rates above the state averages show that 29 per cent of the accidents were concentrated on 4 per cent of all rural state highway mileage. This 4 per cent, or 661 miles, accounted for only 15 per cent of the annual travel. On the prone mileage there were 7.6 accidents per mile of highway as compared to 1.1 for the entire state system. If the accident rate per mile for the entire state system had been the same as that of the prone mileage, Ohio could have expected approximately 123,000 accidents on rural state highways during 1947 instead of the reported 17,431.

Rates computed by this method should prove of value in determining the related accident hazard of various highways as compared to other highways in the particular area and should be an effective basis for programs of widening, relocation and future construction.

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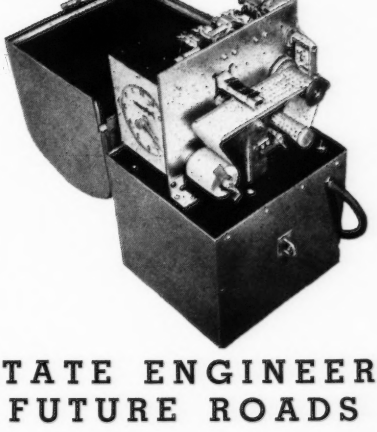
organizations with budgets, staff and programs. Of approximately 1,000 cities of 10,000 or more population, 23 per cent report active safety organizations. Much more community action is needed, with state agencies providing leadership and assistance.

Lack of funds to provide trained personnel, equipment and other facilities has hampered both state and community highway safety programs.

INSTITUTE OF TRAFFIC ENGINEERS FOUNDED 1930

MEETS IN OCTOBER



STATE ENGINEERS PLAN FUTURE ROADS WITH

Traficounter

State highway engineers, the original users of Traficounters, have this to say about the value of these precision built instruments in their highway planning.

1. "Our portable traffic recorders are used periodically for traffic counts on urban streets and for determining changes in traffic at scattered points on our rural highways.

2. "Mechanical counting equipment supplies most of the traffic information gathered."

3. "In every case (of planning for new roads and improvement of old roads) the value of traffic plays a very important part in determining the extent of such work and mechanical counting equipment has been found to be essential in economically gathering such data."

The Traficounter is twice as fast as any other counter of motor traffic; essentially an electric counter which records the over-lapping cars as they cross the dectector. It assures accuracy, is on the job 24 hours a day, and will save many man hours. **Streeter-Amet Company**, 1726 Belle Plaine Avenue, Chicago 13, Illinois.

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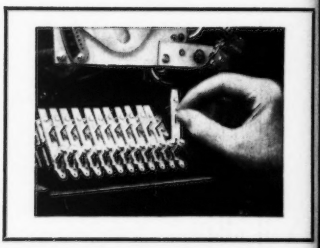
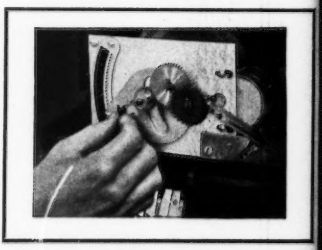
Traffic Signal Controller

Great Features of a Great Controller . . . features that insure the superiority of Marbelite Traffic Signals

1—MID interconnected or non-interconnected controller is expandable up to 18 intervals, 16-signal circuits and 3 offsets.
2—MY-1, same controller, but expandable to 10 signal circuits and 1 offset only.
3—New, permanent magnet type motor which is exceptionally strong and can operate only in synchronous speed.
4—Motor does not require any periodic sychronous check up.
5—Motor starts and stops the dial instantly and will not permit any coasting of the dial.
6—There are only as many dial keys required as there are signal changes. No blind keys required.
7—Blind intervals are advanced automatically through a speed circuit contact.
8—Each cam is capable to take care of three 6 fixed interval cycles, two 9 fixed interval cycles or one 18 fixed interval cycle.
9—The total time cycle gear mechanism is self-adjusting and automatically locks itself in the correct position.
10—A new type solenoid without stop springs or stop arms. Relay plunger stops through magnetic brake action at end of stroke.
11—The cam mechanism is very sturdy and positive in its operation.





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